Sky and TELESCOPE

In This Issue:

Jupiter and Eclipses of the Sun and Moon

Eclipses

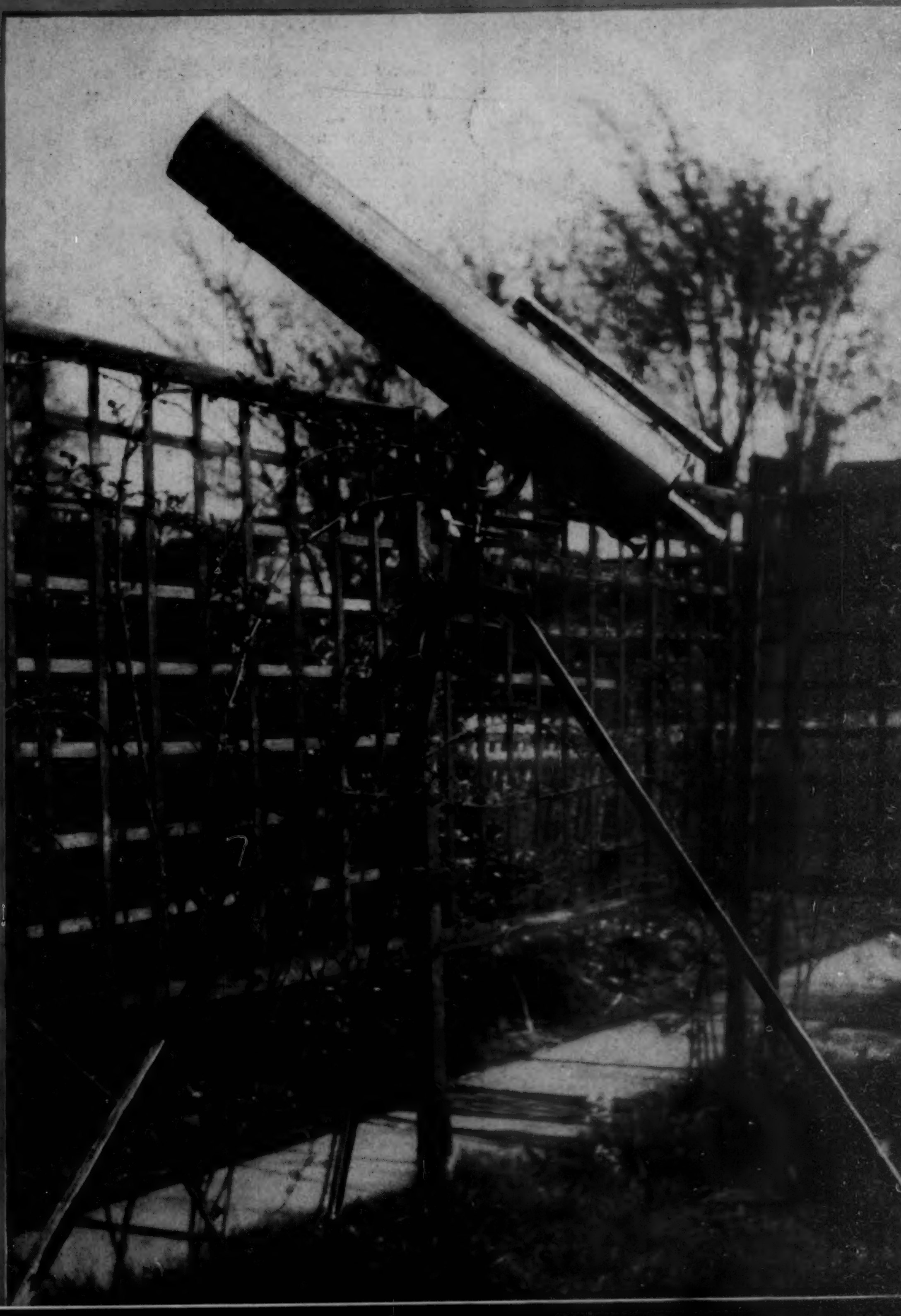
The Search for New Stars

Stars for May

★

Vol. VI, No. 7
MAY, 1947
Whole Number 67
25 cents

★



200-year-old telescope

Sky and TELESCOPE

CHARLES A. FEDERER, JR., *Editor*; HELEN S. FEDERER, *Managing Editor*

NEWS OF CURRENT COMETS

Comet Bester, which was discovered on November 1st in South Africa, has moved northward and is to be located this month in Triangulum. An ephemeris by Jorge Bobone, of Cordoba Observatory, predicts a magnitude of 12.3 throughout May, and the comet will be fainter in June.

Comet Jones is another object which will probably be of the 12th magnitude during May, when it is traveling northwestward through Cygnus. During June it will be fainter still, but on Harvard Announcement Card Nos. 792 and 793 Dr. Leland E. Cunningham, Students' Observatory, University of California, Berkeley, gives its ephemeris for the rest of 1947.

Comet Grigg-Skjellerup is listed in the British Astronomical Association *Handbook* for 1947 as one of the more favorable returns of the year, and on March 11th was observed at Lowell Observatory, Flagstaff, Ariz., and at the Union Observatory in South Africa, not far from its predicted positions. It was of the 11th magnitude, but its brightness was expected to increase rapidly as it approached perihelion passage on April 18th. During May the comet should be bright enough for amateur instruments, but a revised ephemeris is not available as we go to press. The following positions are from the BAA *Handbook*; they differ considerably from the probable positions and are to be taken only as guides to the general position and motion of the comet: May 7, $22^h\ 59^m.0$, $+20°\ 31'$; May 15, $22^h\ 34^m.0$, $+24°\ 34'$; May 23, $22^h\ 19^m.4$, $+27°\ 17'$; May 31, $22^h\ 09^m.0$, $+29°\ 16'$.

Comet Rondanina-Bester was discovered on March 26th in South America and on March 25th in South Africa, when it was of the 11th magnitude, in the south circumpolar region of the sky. It is now moving northward, with perihelion passage expected on May 20th. Positions predicted by Dr. Cunningham during April were: April 13, $3^h\ 4^m.3$, $-64°\ 39'$; 17, $2^h\ 45^m.9$, $-55°\ 11'$; 21, $2^h\ 35^m.9$, $-46°\ 51'$.

Comet Becvar, latest visitor among our cometary guests, was found on March 27th at the Skalnate Pleso Observatory in Czechoslovakia, when the comet was of the 9th magnitude. It is traveling rapidly southward, with perihelion passage expected about May 4th, when it will also be too close to the sun in the sky for favorable observation.

VOL. VI, NO. 7
WHOLE NUMBER 67

CONTENTS

MAY, 1947

COVER: A 4-inch Gregorian reflector, made by James Short about 1750, which is still in active use today. It is owned by R. W. Potts, Cambridge, England. (See page 16.)

BACK COVER: A portion of the moon near last quarter, from a Lick Observatory photograph taken with the 36-inch refractor by J. H. Moore and J. F. Chappell. This is Plate XIV in the series. (See In Focus.)

SKY AND TELESCOPE is published monthly by Sky Publishing Corporation, Harvard College Observatory, Cambridge 38, Mass. Entered as second class matter, April 28, 1939, at the Post Office, Boston, Mass., under Act of March 3, 1879; accepted for mailing at the special rate of postage provided in Paragraph 4, Section 538, Postal Laws and Regulations.

Subscriptions: $3.00 per year in the United States and possessions, and to members of the armed services; Canada and all countries in the Pan-American Postal Union, $3.50; all other foreign countries, $4.00. Make checks and money orders payable to Sky Publishing Corporation. Send notice of change of address two weeks in advance. Circulation manager: Betty G. Dodd.

Editorial and general offices: Harvard College Observatory, Cambridge 38, Mass. Unsolicited articles and pictures are welcome, but we cannot guarantee prompt editorial attention, nor are we responsible for the return of unsolicited manuscripts unless return postage is provided by the author.

Advertising director: Fred B. Trimm, 19 East 48th Street, New York 17, N. Y.; ELdorado 5-5750.

Jupiter and Eclipses of the Sun and Moon

By Paul W. Stevens, *Astronomy Section, Rochester Academy of Sciences*

THOSE OF OUR READERS who are fortunate enough to be in Brazil to see the total solar eclipse this month will notice the brilliant planet Jupiter, but not during the eclipse. Instead, the planet dominates the midnight sky of the Southern Hemisphere, and about two weeks before and after the eclipse, occultations of Jupiter by the practically full moon will be visible over much of the area covered by the belt of totality.

Many observers will recall the added charm which Jupiter contributed to the beauty of the solar corona at the time of the New England eclipse of August 31, 1932. Then the planet was within five degrees of the sun, having been in conjunction with that body that many days earlier. On September 22, 1968, two saros intervals later, a similar event will take place, because of a periodicity which we shall note in Jupiter's motions and those of the sun and moon and the nodes of the moon's orbit.

Two special observing situations interest us: 1. A conjunction of Jupiter with the sun (and the moon) at the time of a solar eclipse, and particularly a total eclipse, which permits Jupiter to be seen close to the sun, as in 1932. 2. A conjunction of Jupiter with the moon during a total lunar eclipse, which permits an occultation of Jupiter by the eclipsed moon. The author has investigated the periodicity of these phenomena, using astronomical constants found in the *American Ephemeris and Nautical Almanac*.

1. During the remainder of the present century, there will be eight total solar eclipses when Jupiter will be observed close to the sun:

June 30, 1954	Sept. 22, 1968
Oct. 12, 1958	July 22, 1990
Feb. 4, 1962	Nov. 3, 1994
May 30, 1965	Feb. 26, 1998

Of these, three are especially noteworthy. The one in 1965 will be the saros anniversary of this year's South American eclipse and will find the planet within two degrees of the sun. Perhaps it will shine through a colorful streamer of the outer corona. For several days before and after the eclipse in 1962, the five conspicuous naked-eye planets will be clustered so close to the sun that none of them will be visible at night. Then, at the time of totality all seven of the celestial wanderers known to the ancients will take part in a pageant of unprecedented glory. It is the eclipse of 1954 that has the greatest interest, however, because it will be the first of the three to take place, and it is the next one to be visible in the United States and Canada. Indeed, it was this eclipse that furnished the challenge to write the present article.

On June 30, 1954, the planet Jupiter will not only be near the moon's descending node, but will also be very close to its own ascending node so that an occultation by the sun is assured. Upon reference to the *American Ephemeris* and extrapolation of the data concerning conjunctions of Jupiter with the sun in 1918, 1930, and 1942, it is predicted that the 1954 conjunction will take place on June 30, 1954, at about 18 hours GCT, with the planet less than two minutes of arc south of the center of the solar disk. This will be about six hours after the eclipse is central at local apparent noon. The time elapsing between immersion and emersion at the solar limbs will be approximately 16 hours. Verification of the actual circumstances will have to await the calculations by the Nautical Almanac Office. Since the interval between first and last contacts of the moon's penumbra with the earth's surface is never more than six hours, it is possible that the planet will be hidden from view for the duration of the eclipse for all observers along its terrestrial path. However, there is a bare chance that immersion of the planet at the sun's eastern limb may not take place until after the total phase has begun. In that case, sunrise observers in this country may possibly witness the extremely rare phenomenon of an occultation of a planet by the moon while the sun is totally eclipsed. In such an event, it will be interesting to compare the brightness of Jupiter with that of the inner corona and the prominences.

2. Because of the small inclination (1° 18′.4) of the plane of Jupiter's orbit to that of the earth, the planet is never seen far from the ecliptic. Consequently, occultations of Jupiter always take place near a node of the moon's orbit. Since the annual heliocentric motion of the planet is only about 30 degrees, it follows that during years when it is occulted by the moon, Jupiter's opposition and conjunction with the sun occur during the seasons of solar and lunar eclipses. Such is the case in 1947, a year which sees the unusually large number of 11 occultations in consecutive months. Opposition takes place only six days before the May eclipse, while conjunction comes 19 days after the annular eclipse of November 12th.

These might seem to indicate favorable times for Jupiter to be near the eclipsed moon, two weeks before or after the solar eclipses, but the lunar eclipses involved are either appulses or partial, and this situation prevails on every such occasion throughout the 20th century. In fact, it is estimated that the last coincidence of the occultation season (Jupiter near the moon's node) with central lunar eclipses came about 550 A.D., a situation which recurs about every 3,300 years. Suppose we assume conjunctions of Jupiter with the totally eclipsed moon to have taken place in general until about the year 1375, but conjunctions with the sun during central solar eclipses to be the rule in the period 1375 to 3025. It may be said that it is very unlikely that any occultation of Jupiter by the totally eclipsed moon has occurred since Columbus discovered America and that another will not occur for at least a thousand years in the future.

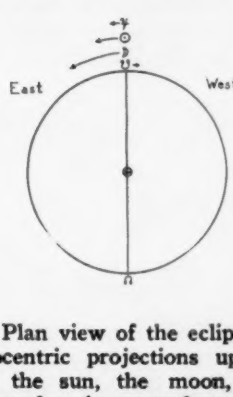


Fig. 1. Plan view of the ecliptic showing geocentric projections upon it of Jupiter, the sun, the moon, and the moon's nodes, in mutual conjunction. The arrows show the regression of the nodes and the direct motions of the other three.

For purposes of reasoning, let us assume a planet is in conjunction with sun and moon at the time of midtotality of a solar eclipse seen total by a geocentric observer. The planet will then be in conjunction with one of the moon's nodes. This is illustrated in Fig. 1, representing a plan view of the projections of the three bodies upon the celestial sphere with the plane of the ecliptic parallel to that of the paper. Let us further assume that the planet's heliocentric longitude varies at a uniform rate as it progresses eastward through the 360 degrees of one sidereal revolution. The moon's node, however, regresses westward at a different rate, which will also be assumed constant. These assumptions represent the average conditions and are, of course, modified by the eccentricities of the orbits

and by other factors beyond the scope of this article. Then the interval between successive seasons of occultation of a planet by the moon will on the average be that period required for the advancing planet to meet the receding nodes alternately. Mathematically, this is expressed as follows:

$$\frac{1}{2X} = \frac{1}{P} + \frac{1}{R},$$

where X is the interval between successive occultation seasons; P is the planet's sidereal period; and R is the period of regression of the moon's nodes.

The derivation can be understood with the aid of Fig. 2, which shows the relative displacements of Jupiter and the moon's nodes one year after their conjunction along the vertical line. Were the factor 2 in the equation omitted, the period computed would be that of conjunctions with the same node of the moon's orbit. This is obviously twice that of the interval between successive occultation seasons, which must take place at both nodes in alternation.

For Jupiter, the periods have the following values expressed in tropical years.

R 18.59988 years
P 11.86223 years
X 3.62148 years

This result is verified by noting that the last season of occultations took place during the fall of 1943 and the winter and spring of 1944. From that time until the beginning of the present year the moon passed north of the planet at each conjunction.

Now consider the frequency with which solar and lunar eclipses take place. In 1947, the two eclipses of the sun are central in the tropics, and the total and annular phases are over four minutes in duration when seen near the meridian. On the other hand, the eclipses of the moon are comparatively minor, being appulses or partials of small magnitude. Next year the solar eclipses will be less impressive and will be visible in higher latitudes, while in 1949 all the eclipses of the sun will be partial. However, the centennial of the California gold rush will be the occasion of a pair of fine total lunar eclipses which can be favorably observed in this country. Then, in 1950, there will be another annular and another total eclipse of the sun, each visible in relatively high latitudes. Further evolution will bring us to 1951, a year of two tropical annular eclipses of the sun accompanied by mere appulses of the moon. This typical variation of solar and lunar eclipses repeats itself five times during the course of one saros cycle.

To understand the mechanism of this change in the characteristics of eclipses in succeeding years, let us refer again to Fig. 1, where we have shown the sun and moon in conjunction with the moon's node. Now consider what takes place when the sun is again in conjunction with this same node after an interval of one nodical year has passed. The sun meets the regressing node, as shown in Fig. 3, about 19 days earlier by the calendar than was the preceding hypothetical eclipse. The moon will be at the position in Fig. 3 (left) and will not overtake the sun until eight more days have elapsed. The sun will then have moved a short distance east of the node, and the character of the eclipse will differ from that of the original.

The moon's phase at the end of one nodical year will be approximately last

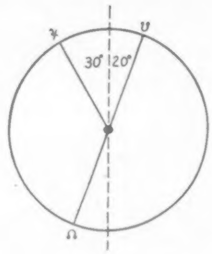


Fig. 2. **Apparent motions of Jupiter and the moon's nodes showing their positions one year from the conjunction illustrated in Fig. 1.**

quarter. At the end of two such periods it will be nearly full, and in four periods it will not be far from the new phase. If we plot the lunar phase at the time of each nodical year as a function of the cumulative interval in tropical years, as in Fig. 4, and assume such phase to vary continuously, we find that "new moon at the node" recurs in about 3.6 years. Mathematically, this is solved by means of the following equation:

$$\frac{1}{Y} = \frac{12}{E} - \frac{1}{M},$$

where Y is the average interval between successive geocentric solar eclipses at a given node; E is the nodical (eclipse) year and equals 346.620031 days (1900); M is the synodic month and equals 29.530588 days. $Y = 1321.27$ days $= 3.61751$ years, assuming 365.242 mean solar days in one tropical year.

Let us not be misled into believing that another eclipse will be observed to

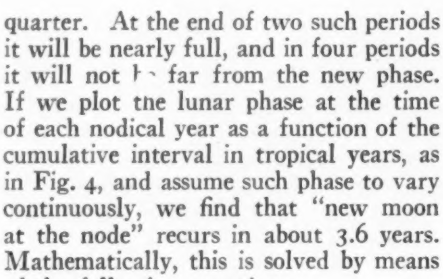


Fig. 3. **Left: Positions of the sun, moon, and nodes after an interval of one nodical year. Right: Their positions at the time of the succeeding solar eclipse.**

be central for a geocentric observer after the period (Y) of 3.6 years has elapsed. Rather will the solar eclipse which occurs nearest to that date be the most nearly geocentrically central of any that take place about that time. To understand the significance of the computed interval, consider what would happen if 12 synodic revolutions of the moon transpired during exactly one nodical year. In that case a geocentric eclipse would occur at every conjunction of the sun with the moon's nodes. The angular speeds of the moon and node relative to the sun would be in the ratio of 12:1 in opposite directions, as would also their cumulative angular displacements from the sun at any time. At multiple intervals of 3.61751 years these angular distances of moon and node are in precisely this ratio. That is the significance of the period (Y).

By applying this analysis to the saros cycle we may see what happens over long periods of time. One saros cycle is 223 synodic months, which equals 18.0300 years. Five average intervals of geocentric solar eclipses = 18.0876 years. Were period (Y) exactly equal to one fifth of the saros, all eclipses in a given series would appear central to a geocentric observer, and the only variation among successive eclipses 18.0300 years apart would be the latitudes and longitudes from which they would be visible. Because of the slight inequality of the two quantities, however, a given saros expires in about 1,200 years, with relatively little change taking place from one eclipse to the next. In each of the years 1936-1938, there was a total eclipse of the sun separated by intervals of 12 synodic months. The one in 1937 was almost geocentric, and had a duration of totality but little short of the maximum possible. It was central in the tropics, while those in 1936 and 1938 were central in the north and south temperate zones respectively. Succeeding eclipses in the respective saros series will take place with the sun 28 minutes of arc west relative to the moon's descending node and will be visible in latitudes which gradually become more northerly. Eventually, the first series will disappear in the north polar regions, a new one will become visible near the South Pole, and the 1938 series will become central to the geocentric observer. The time of the best solar eclipse will have been retarded by an entire nodical year in comparison to the saros.

Now let us see where Jupiter fits into this ever-shifting picture. We notice an amazing similarity in the two intervals derived.

Jupiter period (X) = 3.62148 years
Eclipse period (Y) = 3.61751 years

Difference = 0.00397 years
= 1.5 days

This means that if a favorable central eclipse of the sun occurs when Jupiter is near one of the moon's nodes, as in 1932, later conjunctions of the planet

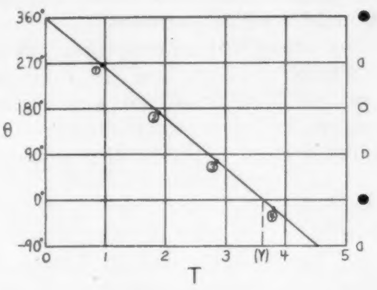


Fig. 4. Graphical solution of the eclipse period (Y). The phases of the moon at intervals of 1-4 nodical years are plotted as a function of the time (T) in tropical years that has elapsed since the condition in Fig. 1. The angle (theta) is the difference in longitude between the moon and the sun, while the symbols to the right of the graph show the moon's phases. It can be estimated that (Y) is about 3.6 years.

with either node will take place during years when there are other such eclipses. The times when lunar eclipses are seen at their best will find the planet midway between the moon's nodes. Then, as in 1949, the actual eclipse seasons will occur when the planet is much nearer quadrature than opposition or conjunction.

The time required for Jupiter to get out of step, so that it is in conjunction with the moon when it passes centrally through the earth's shadow, is longer than the duration of a saros series. It is the time necessary for the small day-and-a-half difference to accumulate to 1.8 years (half the period Y). If we let it equal (Z), its magnitude may be calculated from the following equation:

$$\frac{1}{2Z} = \frac{1}{Y} - \frac{1}{X}.$$

The value of (Z) can not be computed with great precision, but it is of the order of 1,650 years. An error of 0.00001 year in the value of (X) or (Y) would change (Z) by four years. This is because their difference is so small that it is not known to many significant figures. It is estimated that Jupiter and the moon will next be in mutual geocentric superposition with the sun about the year 2200. Applying the 1,650-year interval to this in either direction gives the dates 550 A.D. and 3850 A.D. already mentioned as the times of coincidence of Jupiter occultation seasons with central lunar eclipses.

This relation between Jupiter and the circumstances of eclipses may be verified in a different way. It is well known that the sidereal revolution of Jupiter falls just short of 12 years, so that 11 synodic revolutions are completed over a period a trifle longer than 12 years. Three such intervals (33 synodic periods) transpire over a time that is approximately two weeks in excess of 36 years. This is just about one week less than the time required for two saros periods to elapse, which means that if the planet is in conjunction with the totally eclipsed sun on a given day, during the eclipse which occurs at the end of two saros periods (36 years, 21 days later), Jupiter will be seven degrees west of the sun. At the time of the intermediate eclipse, Jupiter will be near opposition to the sun. The seven-degree westward shift is consistent with the fact that 10 average intervals between conjunctions of the planet with alternate nodes of the moon (10 times Y) take slightly longer than two saros cycles.

Because of the eccentricity of the moon's orbit, there will not always be a favorable total solar eclipse when Jupiter is near the moon's nodes, the condition necessary for a striking effect during totality. Sometimes the eclipse will be annular. At other times the planet will be close to opposition when the favorable solar eclipse occurs, which is the case this year. The table gives the months of conjunction of Jupiter with the alternate nodes, together with the dates and characteristics of the nearest solar eclipses for the saros period following the 1932 eclipse. Note the application of the 3.6-year interval.

Node	Date of conjunction of Jupiter with node	Opposition or conjunction	Date of eclipse	Type
Descending	Oct. 1932	Conj. Aug. 26	Aug. 31	Total
Ascending	May 1936	Oppos. June 10	June 19	Total
Descending	Jan. 1940	Conj. Apr. 11	Apr. 7	Annular
Ascending	Aug. 1943	Conj. July 30	Aug. 1	Annular
Descending	Apr. 1947	Oppos. May 14	May 20	Total
Ascending	Nov. 1950	Oppos. Aug. 25 Conj. Mar. 11, 1951	Sept. 11 Mar. 7	Total Annular

LETTERS

Sir:

The reversal on the moon can be done with any telescope, and although it seems easier to do by backing away from the instrument until only a couple of craters can be seen and reversed, then closing in to the eyepiece again to see everything on the moon reversed, it is not necessary to back away. Once you know you can do it, it is difficult to see the moon right anymore. I believe it is mental, and can be done by anyone interested who can reverse photographs.

LEO AALTO
Worcester, Mass.

Sir:

"Ask the Moon and It Will Answer," by L. S. Copeland in the March issue, is most interesting, but the moon, "the inconstant moon that monthly changes in her nightly orb" has given him the wrong answer. The correct answer is that both meteoric bombardment and intense volcanic activity are responsible for the moon's facial expression.

The meteoric bombardment was caused by the debris following in the wake of the major catastrophe when the moon was expelled from the earth. Jeffreys in his book, **The Earth,** states that the moon was probably formed within 10,000 years of the formation of the earth and, summarizing, says the earth probably became solid within 15,000 years of its ejection from the sun. It is possible there were 5,000 years of liquid earth to absorb the debris that was drawn back to the earth by its gravity. The moon, with its small mass and little or no atmosphere to retain the heat, rapidly formed a thin crust and it was this crust that was battered by the debris, at times breaking through and permitting the magma to ooze up through and at times splashing great masses of semi-liquid magma up, to fall back as central peaks, just as slow-motion pictures of a golf ball falling into a receptacle of milk show a similar phenomenon. Only one or two hundred masses of four or five cubic miles each would be sufficient to cause all the larger crater rings, as the high velocity of around 1½ miles per second would be sufficient to produce a violent explosion when the energy of motion was converted into heat.

Nasmyth and Carpenter's model of Aristarchus is quite misleading. Aristarchus is shown with a central peak and Goodacre mentions a fine central peak. But the fact remains, there is no central peak! With a relatively low rim and the bottom of the crater considerably lower than the surrounding territory, and with the white pulverized rock or pumice blown over a large area by the force of the explosion following the impact, it is a fine example, like Tycho, of a late meteoric crater.

There is a mistaken idea that volcanic activity on the moon would be six times as violent as on the earth. A big firecracker makes a big explosion, a small firecracker a small one. It is as simple as that. The earth imposes gravitational checks — the weight of the crust — until the forces beneath are built up enough to break through. The pressure of the moon's crust would be but one sixth that of the earth so that only one sixth the force would be needed to break through. Perhaps the great red spot is an example of Jupiter's volcanic action, which must be more violent than ours when it breaks through Jupiter's crust.

In brief, bombardment by debris together with cooling, cracking, faulting, folding, exudation and subsidence are responsible for the moon's facial appearance.

CHESLEY BONESTELL
Hollywood, Cal.

We have no accepted proof, of course, that the earth came from the sun or the moon from the earth; their origins are still unknown.—ED.

Amateur Astronomers

Philadelphia's Franklin Institute Is to Be Headquarters for July Exhibit and Convention

THE EXHIBITION of astronomical demonstration devices designed and built by amateurs, and instruments and teaching equipment in regular use, to be held as part of the national convention of amateur astronomers in Philadelphia on July 4th weekend, will be located at the Franklin Institute, which is to be headquarters for the entire convention.

Edwin F. Bailey, representing both the Amateur Astronomers of the Franklin Institute and the Rittenhouse Astronomical Society, is in charge of the exhibition, and any inquiries concerning it should be addressed to him at The Franklin Institute, Philadelphia 3, Pa. Telescopes and other astronomical equipment, photographs, and demonstration devices are the major classifications into which the displays will be divided. A small entry fee will be charged for each exhibit, to be applied toward prizes in the several categories.

The sessions will begin with registration on the morning of Friday, July 4th, at the Institute, which is on the Parkway at 20th St., only a few minutes' walk from the center of Philadelphia. Business sessions will be scheduled for the Amateur Astronomers League, whose first convention this will be.

Descriptions of actual astronomical work carried on by individuals or groups will make up one of the sessions. Persons interested in presenting brief papers (limited to not more than 15 minutes) should notify the Program Committee, Amateur Astronomers Convention, at the Franklin Institute, as soon as possible, so that time can be allotted and the program completed.

A special committee has been appointed to make reservations for visiting delegates at nearby hotels at a minimum of expense. Please notify the Reservations Committee about your requirements, and you will receive direct word about the availability of rooms and their cost. A lunchroom at the Institute will be open for inexpensive soup, sandwich, or platter noon meals on all three days. Other meals are being scheduled, and announcement of the time, place, and cost of each will be made next month.

Sproul Observatory of Swarthmore College will be the goal of a special visit on Friday afternoon. The 28-inch refractor and other equipment will be available if observing conditions permit. A picnic or buffet supper will be served, depending upon the weather. Bus transportation is planned for this and any other special visits.

The Saturday sessions will be followed by visits to the museum of the Franklin Institute, and inspection of the special convention exhibits. There will also be opportunity for inspection of a Peerless Planetarium installation.

A breakfast meeting on Sunday will give opportunity for the reports of committees and the transaction of the convention's final business. A special demonstration of the Fels Planetarium by its director, Dr. Roy K. Marshall, will bring the convention to its formal close at about noon on Sunday.

St. Louis Activities

The St. Louis Amateur Astronomical Society has about 20 members, of which 15 are active. We meet at the homes of various members on the first Saturday of each month, and also have field trips when the weather permits.

Our equipment consists of a 12-inch, an 8-inch, a 6-inch, and a 4-inch telescope, all Newtonian, an 8-inch Cassegrainian, and two 4-inch refractors. Our officers are A. M. Obrecht, president; S. L. O'Byrne, vice-president; Earl C. Bess, secretary and treasurer. Mr. Obrecht will be glad to answer inquiries from anyone interested in taking part in our activities. He may be reached at 2913 Park Ave., St. Louis 4, Mo.

Elmer H. Buchser

Part of the group gathered at the first meeting of the Sociedade Brasileira dos Amigos da Astronomia, Fortaleza, Brazil.

New Society in Brazil

We are pleased to inform you that we have just founded, here in Fortaleza, in the state of Ceara, an amateur society, the Sociedade Brasileira dos Amigos da Astronomia, whose purpose is to increase in our country interest in the magnificent science of the skies.

The S.B.A.A. has at the present time about 100 members. We make our observations with a 61-mm. refractor, property of Rubens de Azevedo, our president, but we hope to obtain in the very near future a more powerful telescope, which will enable us to improve our observing methods.

Our first meeting was held on the 26th of February, Flammarion's birthday, and was presided over by Professor Euclides Cesar. The first directorship of the S.B.A.A. is as follows: Sr. de Azevedo, president; Estolano Polary Maya, vice-president; Zorrilo de Almeida, general secretary; Darcy Costa, first secretary; Baltasar Coelho Neto, second secretary; Eunar Almeida de Oliveira, treasurer; Clidenor Capibaribe, orator; Theodorico da Costa Barroso, librarian.

Darcy Costa
Av. Joaquim Tavora 3632
Fortaleza, Ceara, Brazil

Amateur Astronomers League

The Amateur Telescope Makers of Boston have voted to become affiliated with the Amateur Astronomers League.

Plans for the Fifth National Convention of Amateur Astronomers, the first convention for the newly formed League, are announced elsewhere on this page.

THIS MONTH'S MEETINGS

Buffalo: At the Wednesday, May 7th, meeting the Amateur Telescope Makers and Observers will see sound movies entitled "The Moon" and "The Solar Family." Rudolph Buecking will address the club at the May 21st meeting on the subject of "Eyepieces." Meetings are at the Buffalo Museum of Science at 7:30 p.m.

Chicago: A special demonstration at the Adler Planetarium is scheduled for members of the Burnham Astronomical Society on May 13th, Tuesday, conducted by the director of the planetarium, Wagner Schlesinger. Members will assemble in the planetarium lobby at 8:00 p.m.

Cincinnati: Dr. Frank K. Edmondson, of Indiana University, will speak on "The Theory of Relativity," at the May 9th meeting of the Cincinnati Astronomical Association. The meeting place is on the University of Cincinnati campus.

Cleveland: "New Information about the Solar System" will be discussed by Dr. G. P. Kuiper, Yerkes Observatory, on Friday, May 2nd, at the meeting of the Cleveland Astronomical Society. The meeting is at 8:00 p.m., at the Warner and Swasey Observatory, East Cleveland.

Detroit: The Detroit Astronomical Society will meet on Sunday, May 11th, at 3:00 p.m., at Wayne University, to hear a talk on "The Spectrum of the Sun," by Dr. Orren C. Mohler, of the McMath-Hulbert Observatory.

Geneva, Ill.: The annual picnic of the Fox Valley Astronomical Society will be held at Aurora College, in Aurora, on Sunday, May 25th. At 4:00 p.m. there will be a lecture on "Man's Place in the Universe," by Dr. Paul E. Martin, Wheaton College. The picnic is at 6:00 on the campus, and at 7:30 sky observations will start.

Indianapolis: The Indiana Astronomical Society will celebrate its founders day on Sunday, May 4th, meeting at Odeon Hall, corner of Ft. Wayne Ave. and North Sts., at 2:15 p.m.

Kalamazoo: Meeting at the science building at Western Michigan College, the Kalamazoo Amateur Astronomy Association will hear a talk by Dr. Paul Rood on "Control and Use of Atomic Energy." The meeting is on Saturday, May 24th.

Madison: At the meeting of the Madison Astronomical Society on May 14th, Bob Burkhalter and Dick Dawley, members of the society, will discuss the application of photography to astronomy. The meeting is at Washburn Observatory at 8:00 p.m.

New York: On May 21st the Amateur Astronomers Association will hold its annual meeting. There will be motion pictures, reports of officers and committees, and elections. The group meets at the American Museum of Natural History at 8 o'clock.

The Junior Astronomy Club annual jubilee, featuring astronomical and non-astronomical fun, will be held at 8:00, Friday evening, May 23rd, at the American Museum of Natural History.

Pittsburgh: On Friday, May 9th, Lt. Comdr. J. C. Potter will speak on the "Use of Celestial Navigation," before the Amateur Astronomers Association of Pittsburgh. Comdr. Potter was the navigator on the original Mars flying boat. The meeting begins at 8:00 p.m. in the Buhl Planetarium lecture hall.

San Diego: At the May 2nd meeting of the Astronomical Society of San Diego, Dr. Clifford Smith, San Diego College, will speak on "The Observatories of the Pacific Coast." The meeting is at 8:00 p.m. in the Electric Building.

Washington: Dr. Joseph Kaplan, director of the Institute of Geophysics, University of California at Los Angeles, will speak at the regular meeting of the National Capital Astronomers. His talk, "Light of the Night Sky," will deal with the composition of the high atmosphere. The meeting is on Friday (not the usual Saturday), May 2nd, at 8 o'clock in the Department of Commerce Auditorium.

Worcester: On May 4th, Sunday afternoon, the Aldrich Astronomy Club will be guests of Dr. Alice Farnsworth, of Mt. Holyoke College, South Hadley, Mass. If the weather is favorable, the visit will continue into the evening for observing with the 8-inch observatory refractor.

On May 6th, Tuesday evening, at 8 o'clock, at the Worcester Natural History Museum, Dr. Fred L. Whipple, of Harvard Observatory, will speak on "Evolutionary Processes in Cosmic Clouds."

FOREIGN MEMBERS OF THE AMERICAN ASTRONOMICAL SOCIETY

Science reports that the American Astronomical Society has elected the following astronomers to honorary membership: M. N. Saha, University of Calcutta, India; G. A. Tikhov, U. S. S. R.; B. Lindblad, Stockholm Observatory, Sweden; J. H. Oort, Sterrewacht, Leiden, Holland; E. A. Milne, Oxford, England; and Bernard Lyot, Meudon Observatory, France.

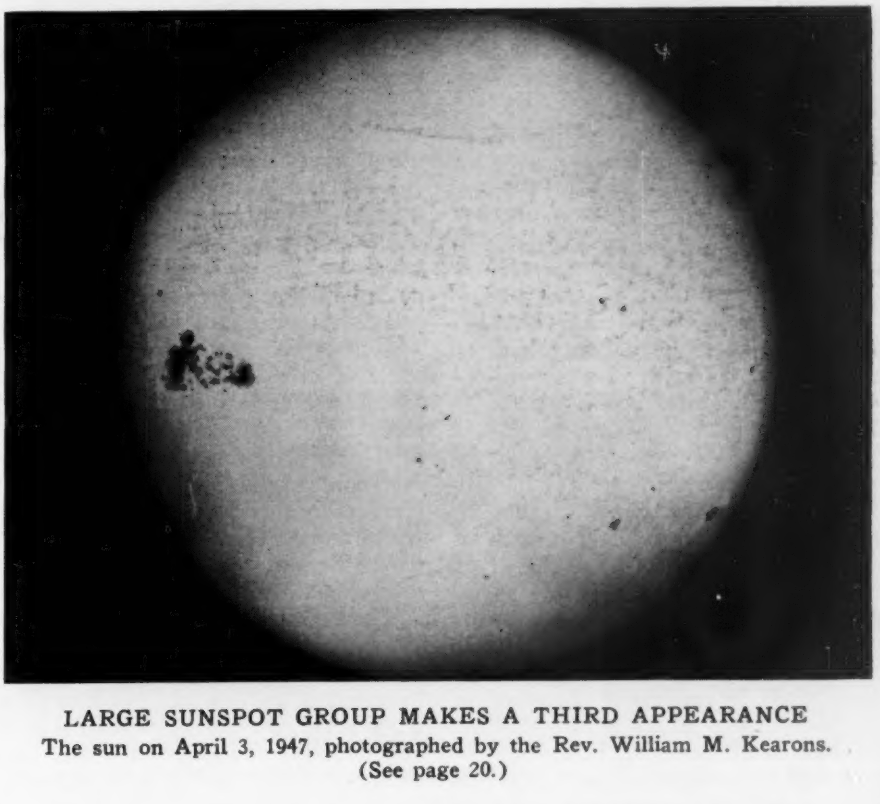
The Strolling Astronomer

At the University of New Mexico, in Albuquerque, Walter H. Haas is editing a new mimeographed monthly publication, *The Strolling Astronomer,* representing the Association of Lunar and Planetary Observers. The first issue is dated March 1, 1947, and the second reports a membership in the new organization of 21 members. One may receive *The Strolling Astronomer* for one dollar for six issues. In his first issue, Editor Haas appeals:

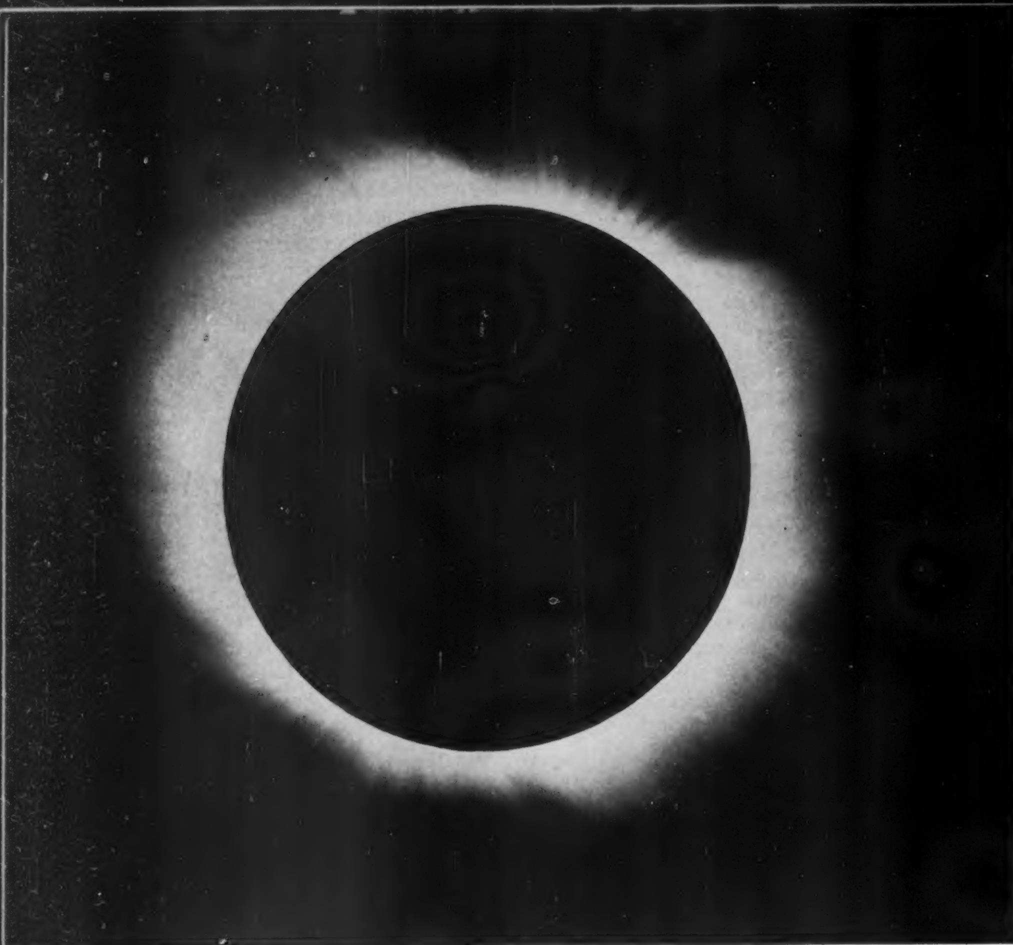
"There exist amateur astronomers; there exist the telescopes they have built; there exist the moon and the planets. This leaflet is an attempt to persuade the party of the first part to use the party of the second part to increase knowledge of the party of the third part.

"We hope to show herein some ways in which John Q. Amateur can profitably study our sister-worlds (perhaps literally neighbor-worlds in an impending age of space travel) and to give him some instructions on how to do so . . . . We urge John Q. Amateur to submit to us the lunar and planetary observations which he makes and shall undertake to study them and to report our findings through published papers . . . ."

The second issue of *The Strolling Astronomer* contains an article by Frank R. Vaughn on "Valuable Contributions to Astronomy by Owners of Small Telescopes." There is also a note by Dr. Lincoln La Paz entitled, "On Possible Contraterrene Meteorites." Dr. La Paz, head of the mathematics department of the University of New Mexico, is counsellor of the new publication.



LARGE SUNSPOT GROUP MAKES A THIRD APPEARANCE
The sun on April 3, 1947, photographed by the Rev. William M. Kearons.
(See page 20.)



When the bright photosphere of the sun is completely covered by the moon, the corona may be seen in all its glory.

ECLIPSES

BY ROBERT R. COLES, *Hayden Planetarium*

I have a little shadow that goes
in and out with me,
And what can be the use of him
is more than I can see.
— ROBERT LOUIS STEVENSON

THE ABOVE LINES from *A Child's Garden of Verses* are certain to strike a familiar note in the memories of thousands who recall those long-ago days when shadows suggested a world of mystery to young and impressionable minds. The grownups who chase shadows are called astronomers, and the shadows are not theirs but belong to the moon or the earth. Indeed, the interest in chasing the moon's shadow at the time of a solar eclipse has led astronomers to the most remote parts of the earth, from the barren wastes of the arctic to the steaming tropics. It has inspired them to put in long months of careful preparation just so that they might procure a few precious photographs and make precise measurements and observations during the very few moments of totality — that time when the observer is completely immersed in the black depths of the moon's shadow. On May 20th, this year, many astronomers will be gathered at vantage points in South America to observe and photograph a solar eclipse, and many others will be anxiously waiting at home to study the results that these scientists obtain.

Since long before the dawn of history the spectacle of a solar eclipse has inspired mixed feelings of fear, wonder, and amazement in the minds of those who have seen it. At first, of course, the phenomenon was interpreted in the light of ignorance and superstition, but today the mechanics of eclipses are well understood and these events can be predicted with very great accuracy. But still they are followed because of the valuable scientific data that may be obtained at such times. And the unearthly beauty of a total eclipse of the sun is a sight that everyone should enjoy at least once in his lifetime. It is a spectacle charged with dramatic suspense the like of which would be hard to duplicate under any other conditions.

There are many interesting stories of ancient eclipses and their influence on mankind. The very earliest of which we have record was observed in China about 4,000 years ago. Although there is much uncertainty concerning the exact date, Oppolzer determined it as the eclipse of October 22, 2137 B.C. This eclipse is doubly interesting today, first because it is the earliest of which we have record, and second because of the classic story of Hi and Ho, the royal astronomers who instead of pursuing the sober ways that astronomers are supposed to follow, imbibed so freely they were unable to announce the impending phenomenon or to participate in the ceremonies attending it. This neglect on their part so angered the emperor that he ordered their execution.

Eclipses of the sun and moon and other astronomical events that occurred in early times provide archeologists and historians with one of their most useful means of fixing important dates that otherwise might not be known.

Today any schoolboy may become familiar with the mechanics underlying both solar and lunar eclipses. While the details are somewhat involved, the basic principles are easily understood. Yet it is surprising how many people seem to be without a clear understanding of what really happens. This is evident by many of the questions received at the Hayden Planetarium when an eclipse is due. And some of these questions even indicate that a few people still view these phenomena more or less superstitiously.

Like the child mentioned in the verse, the earth and the moon are accompanied by shadows that extend into space in the direction opposite the sun. Everybody should be somewhat familiar with the earth's shadow since we pass through it each night. As a matter of fact, the shape of this earth shadow has provided the basis for a question that has proved popular on radio quiz programs: "What is the shape of night?" The answer is: "Ice-cream cone shaped." In this sense we find that night has three dimensions, the earth itself corresponding to the ice cream in the cone of night. The moon's shadow is like that of the earth but of smaller size because of the moon's lesser diameter.

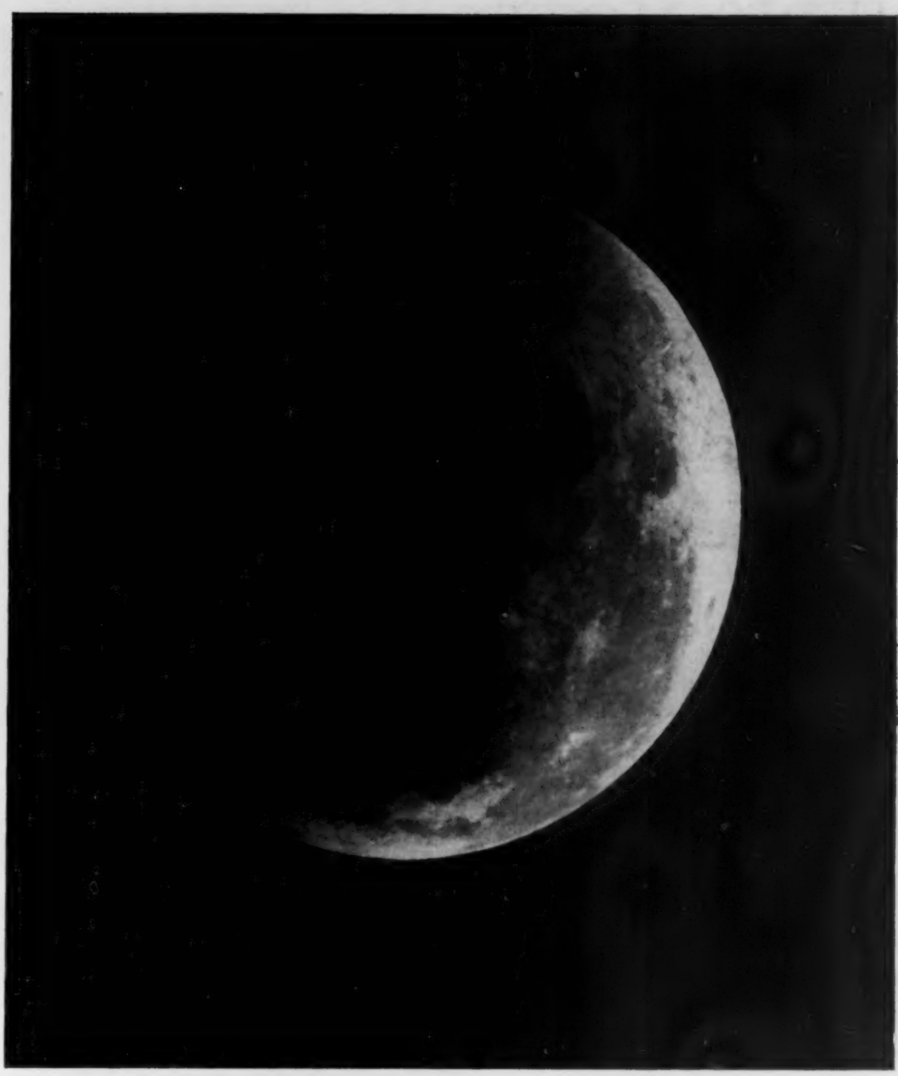
When the moon is in line between the earth and the sun its shadow extends toward the earth. Sometimes part of this shadow touches the earth and we have a total eclipse of the sun. The main thing to remember is that in a solar eclipse the moon moves between the earth and the sun. In the case of a lunar eclipse, the moon must be on the opposite side of the earth from the sun. Then, as our satellite moves through the earth's shadow, an eclipse of the moon takes place. Here it is the earth getting between the moon and the sun that causes the eclipse.

From this very simple explanation it would appear that there should be a solar eclipse at the time of every new moon and a lunar eclipse at every full moon. But it is not as simple as that. If the moon's orbit were in the same plane as the earth's orbit around the sun, that is

exactly what would happen. Actually, however, the moon's orbit is inclined about five degrees to the ecliptic, and it is only at those times when the moon happens to be at or near one of the nodes, where the orbits intersect, that the three bodies are nearly in the same line and an eclipse can occur. At other times the shadow of the moon or earth just disappears in space.

There are many variables that determine the kind of eclipse that will result. In the case of a solar eclipse it may be partial, total, or annular. A lunar eclipse may be either partial or total. A solar eclipse that is total for certain observers in a very narrow path over which the direct shadow of the moon passes will be partial for observers who happen to be on either side of that shadow path. The very greatest width of the direct shadow (*umbra*) of the moon is about 167 miles, while persons in an area over 4,000 miles in diameter may be within the penumbra of the shadow and observe a partial eclipse. Sometimes, however, the moon may move centrally across the face of the sun, but if its apparent diameter is less than that of the sun, there will be a narrow ring of sunlight, an annulus, shining around the moon's disk. This is called an annular eclipse and occurs when the moon is so distant the umbra of its shadow fails to reach the earth's surface.

Despite the beauty and interest of a solar eclipse, it is nevertheless true that millions of persons are never fortunate enough to observe one. S. A. Mitchell tells us in his famous popular book, *Eclipses of the Sun,* that since the sixth century only 18 eclipses have been observed from the British Isles and in that time the inhabitants of London enjoyed two, Dublin two, and Edinburgh five.



A partial phase of the eclipse of the moon of August 26, 1942. Photo by Peter A. Leavens.

Counting partial, annular, and total eclipses, it is possible to have as many as five solar eclipses in a year. The least number of solar eclipses is two per year. Lunar eclipses are less frequent. Yet, despite this fact, far more people have seen total eclipses of the moon than total eclipses of the sun. This paradox is true because lunar eclipses, when they occur, can be seen from more than half of the earth while total eclipses of the sun may be observed only from the limited region covered by the moon's direct shadow.

Aside from the incomparable beauty of the spectacle, there are good scientific reasons to attract astronomers half way around the world to observe the few seconds of totality at a solar eclipse. Among the many observations that are made are precise checking of the time, measurements of the relative positions of the sun and moon, photography of the corona and prominences, photography of the flash spectrum, and photographic measurement of the stars near the sun to check the Einstein effect.

Since the days when man viewed eclipses with fear and superstition he has learned to study them objectively and has discovered in them many fascinating shreds of evidence that help him unravel other secrets of the universe.

ARGENTINIAN AMATEURS PLAN TO VIEW THE MAY 20TH ECLIPSE

A group of members of the Asociacion Argentina "Amigos de la Astronomia," under the leadership of Dr. Bernhard H. Dawson, will be at Itati, province of Corrientes, Argentina, just across the Parana River from where the line of central eclipse enters Paraguay. The instruments will be installed on a large balcony of a church, facing northeast and some 26 meters above the street level.

For most of the members of the group it will be an excursion to see the eclipse rather than an expedition to observe in the scientific sense, and what observations will be attempted will depend largely on the abilities of those present. Two programs, however, are definite.

The first is to record the entire eclipse on 35-mm. positive movie film, with a Dallmeyer lens of 48 centimeters focus. During the partial phases a frame will be taken each four seconds with exposure 1/20 second at f/90 through a deep orange filter. During the expected 176 seconds of totality, exposures will be made at f/6 without filter, with exposure times from ½ to 10 seconds.

Preference during totality will be given to the photometric program, which consists of the exposure, *en echelon,* from about 30 seconds to nearly full duration of totality, of several series of areas on bromide paper to the direct illumination coming from the corona and the neighboring region of the sky. These sheets are to be calibrated by the exposure of similar areas to the full moon and surrounding sky with the same apparatus, some exposures two weeks before and others two weeks after the eclipse.

Times of contacts, shadow bands, and other phenomena may also be observed as the inclinations and abilities of the members of this eclipse-observing group suggest.

NEWS NOTES

By Dorrit Hoffleit

ASTRONOMERS HONORED

At its celebration of the 400th anniversary of the birth of Tycho Brahe, the University of Copenhagen awarded honorary degrees to 11 astronomers, representing eight nations: E. Hertzsprung, Denmark (retired director of the Leiden Observatory, Holland); Sir Harold Spencer Jones and F. J. W. Stratton, England; A. Danjon, France; J. H. Oort, Holland; S. Rosseland, Norway; B. Lindblad, Sweden; H. Shapley and O. Struve, United States; G. A. Shajn and A. A. Mikhailov, U. S. S. R.

PARENTS OF MESOTRONS

Last summer the Army Air Forces collaborated with the National Geographic Society and the Bartol Research Foundation in securing cosmic-ray observations from B-29 flights between the equator and southern Canada, at altitudes ranging from one to six miles. Dr. W. F. G. Swann, of the Bartol Foundation, summarized the results with, "We might say that the father of the mesotron is a proton and he has 10 children."

The mesotron is the most penetrating charged particle known. Some mesotrons pass through 75 feet of lead. They have a lifetime of less than 1/1,000 of a second and hence must have originated within our atmosphere. Since charged particles falling to the earth are bent by the earth's magnetic field, they tend to be more numerous in high than in low latitudes.

The recent flights have shown, however, that at 25,000 feet, 50 per cent more mesotrons are found at 48° latitude than at the equator, while at 33,000 feet the increase at high latitudes is only 33 per cent.

"The experimental fact that the intensity does not increase beyond 48 degrees north practically necessitates the existence of a particle lighter than the proton; and the latitude of 48 degrees, where the increase in question stops, is well in harmony with the assumption that the mesotron has a mass one-tenth of that of the proton and that each proton produces 10 mesotrons."

The same B-29 which carried out this work is scheduled to observe cosmic rays during the total eclipse in Brazil this month. The Bartol Foundation is also preparing a series of radiosonde balloons to measure cosmic radiation in the stratosphere.

While experimental physicists are busily investigating the properties of those particles of whose existence they are already aware, theoretical workers are also forging ahead with more ideas on what to be looking for. Professor J. R. Oppenheimer, former head of the Los Alamos Laboratory, has postulated a new subatomic particle, the *neutral* meson (*Time,* February 10, 1947). It is reputed to have a mean life of only one hundredth of a sextillionth of a second. That is probably why it has not yet been discovered.

S. O. S. FOR GREEK ASTRONOMERS

During the past year over 1,000 parcels have been sent to needy European scientists by the Committee of U. S. Scientists' Wives, of which Grace H. Smith, National Bureau of Standards, Washington 25, D. C., is secretary. Through this committee, Dr. W. E. Deming, of the Bureau of the Budget, transmits an appeal in behalf of Greek scientists, astronomers in particular. Dr. Deming has recently returned from Greece, where he found that civil service assistants in the Laboratory of Astronomy and National Observatory at Athens and in the astronomical station at Pentele, under the direction of S. Plakidis, are paid only about 30 dollars a month, while lunch alone costs them about a dollar a day. Government appropriations for supplies, instruments, books and journals amount to 350 dollars for the whole department.

Science lists the following staggered suggestions for donations: food and clothing; books and reprints; subscriptions to astronomical and mathematical journals; paper, pencils, pens, even scratch paper; any obsolete adding or computing machine; a slide rule; and the following equipment: Hale-type spectrohelioscope; spectroheliograph; an astrographic refractor (15-20-inch); and a Schmidt camera.

STELLAR ROTATION AND THE ZEEMAN EFFECT

Six months ago Dr. Otto Struve, of Yerkes Observatory, put the question, "What is the spectrum of a rapidly rotating star like, when it is observed from the direction of the poles?" (*Sky and Telescope,* No. 61, 1946.) The most recent *Astrophysical Journal* gives an answer. H. W. Babcock, of Mount Wilson Observatory, considers the "Zeeman Effect in Stellar Spectra."

Briefly, the Zeeman effect is the splitting of the lines of a spectrum into several components when light passes through a magnetic field. The general magnetic field of a star is assumed to be correlated with the speed of rotation of the star. For the sun the magnetic field strength is about 50 gauss and the equatorial rotation about two kilometers per second. In early-type stars, the equatorial rotational speeds average about 60 kilometers per second. Thus, if the magnetic field strength and the rotational speeds were directly proportional, the early-type stars should have fields of about 1,500 gauss. Such strong fields should produce detectable effects in the spectra.

If the axis of rotation of a star of this sort were exactly along the line of sight, the spectrum would show no ordinary broadening of the lines from the Doppler effect; but the strong magnetic field, with its axis also close to the line of sight, should split the lines into two opposite circularly polarized components. To test this, Babcock selected a star, 78 Virginis, whose spectrum has very narrow lines, indicative of no rotational component in the line of sight, but belonging to the class of stars for which rapid rotation is common. If this star does rotate, its axis must be pointing almost directly toward us.

Employing a quarter-wave plate of mica and a plane-parallel crystal of calcite, the Mount Wilson astronomer analyzed the spectrum of 78 Virginis to detect the polarized components of its light caused by the Zeeman effect. He found a field strength of 1,500 gauss, corresponding to the expected rotational velocity of 60 kilometers per second. While the exactness of this agreement is only fortuitous, the work is of high significance in establishing this method for investigation of problems in stellar rotation where the geometric conditions preclude the standard methods.

While this large magnetic field strength was found for an early-type star, Babcock could find no evidence of the Zeeman effect in the late-type star Epsilon Pegasi. This, too, was in accordance with expectation, since late-type stars have slow rotation rates, if any.

YERKES AND McDONALD STAFF REORGANIZATION

Effective July 1, 1947, there will be an expansion and general reorganization of the department of astronomy of the University of Chicago, which includes the Yerkes Observatory and the personnel of the McDonald Observatory of the University of Texas. Dr. O. Struve will continue to guide the policies and lay the broader plans for the department, of which he is chairman. Among other recommendations to the University of Chicago and the University of Texas, Dr. Struve proposes:

That Dr. Gerard P. Kuiper be made director of Yerkes and McDonald observatories, with Dr. W. A. Hiltner continuing as assistant director; that a theoretical section be created under the supervision of Dr. S. Chandrasekhar, who will continue to reside at Williams Bay; that Dr. W. W. Morgan be named managing editor of the *Astrophysical Journal*; and that the Chicago teaching section be revived under T. L. Page.

Dr. Struve will reside at Williams Bay and at Mount Locke, Tex.

In Focus

LYING to the east of the region of Plates X and XI, which appeared in the January and February issues, some of these lunar features were described in those In Focus columns. Below are additional descriptions of the more outstanding and interesting formations on this part of the moon. All named features are sketched on the accompanying key chart. Spellings follow the International Astronomical Union's **Named Lunar Formations,** and biographical information is from the British Astronomical Association's **Who's Who in the Moon.**

Bullialdus. The French astronomer and historian Boulliaud (1605-1694) is credited with recognizing the periodicity of Mira. Bullialdus is an interesting crater similar to Copernicus; the walls are terraced and complicated, and there is a central peak.

Campanus. A walled plain about 30 miles in diameter, named by Riccioli for a 13th-century author who wrote on astronomy and astrology.

Capuanus. A walled plain with mountains about 8,000 feet above its interior, and several craters in the rim.

Gauricus. A ring plain with high walls, and a considerable number of craterlets in its rim.

Guericke. A ruined formation, with its walls practically non-existent on its western side and to the south. Named for a 17th-century physicist, who in 1654 used Magdeburg hemispheres to illustrate air pressure. His device consisted of two hollow hemispheres which, when placed together and the air pumped out of them, could not be separated even by "two teams of eight horses." He invented several forms of air pump and a water barometer, and showed that sound is transmitted by air.

Hainzel. A large walled formation which appears to Goodacre as "two large rings which have coalesced," with a rough interior. Paul Hainzel observed at Augsburg with a quadrant designed by Tycho, and his observations, especially of the nova of 1572, were used by Tycho at Hveen.

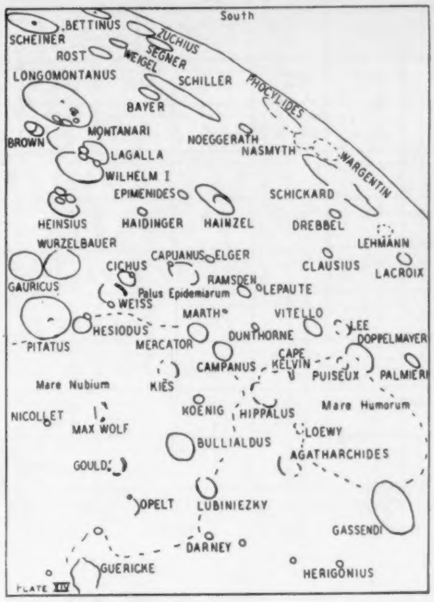
Heinsius. A walled plain with two large craters in its rim, and one in the interior.

Lubiniezky. Named for a 17th-century Polish student of comets, this is an incompletely walled formation.

Mare Humorum is the Sea of Moisture, so named by Riccioli.

Mercator. Named for the 16th-century map maker, inventor of the Mercator projection, this formation is similar to nearby Campanus.

Nasmyth. Named for James Nasmyth, Scottish engineer, famous as co-author of **The Moon.** The Carpenter of the well-known book is also commemorated on the moon. Their book is illustrated by their own novel method — from many patiently delineated drawings resulting from hours of visual observation, they constructed models, which they then photographed. Formation Nasmyth is difficult to identify at this illumination.



Palus Epidemiarum, given by the BAA as Palus Epidiarum, is the Marsh of Epidemics, so named by Schmidt.

Schiller. An elliptical walled enclosure made more so by foreshortening. The floor is comparatively smooth. This formation is named for a 17th-century monk who is known now only as the creator of a scheme to rename the constellations for biblical characters and objects.

Wargentin. A Swedish astronomer who was director of Stockholm Observatory in the late 18th century, Wargentin was a very accurate worker, much honored in his own country and abroad. On the moon this is an anomalous object, but practically undiscernible on this picture. It is a ring plain whose interior has evidently been filled to the level of the walls with lava. A Nasmyth and Carpenter illustration of Wargentin appeared on page 11 of the March issue.

Max Wolf. This incomplete formation is named for the German astronomer (1863-1932) who was director of Königstuhl Observatory at Heidelberg. He inaugurated the photographic search for new asteroids, and developed other programs in celestial photography. He did considerable work in spectroscopy, discovering the bright-line **O** stars known as Wolf-Rayet stars, discovered thousands of nebulae, and was the first to discover rotation in an extragalactic nebula, M81.

Planetarium Notes

ADLER PLANETARIUM

900 E. Achsah Bond Drive, Chicago 5, Ill. Wabash 1428

SCHEDULE: Mondays through Saturdays, 11 a.m. and 3 p.m.; Sundays, 2:30 and 3:30 p.m.

STAFF: *Director,* Wagner Schlesinger. *Other lecturer:* Harry S. Everett.

May: OUR STAR, THE SUN. We turn our attention to the most important celestial body, its constitution, structure, and its atomic source of energy which makes life possible here on earth.

June: AROUND THE WORLD IN 60 MINUTES.

BUHL PLANETARIUM

Federal and West Ohio Sts., Pittsburgh 12, Pa. Fairfax 4300

SCHEDULE: Mondays through Saturdays, 3 and 8:30 p.m.; Sundays and holidays, 3, 4, and 8:30 p.m.

STAFF: *Director,* Arthur L. Draper. *Other lecturers:* Nicholas E. Wagman, J. Frederick Kunze.

May: THE END OF THE WORLD. This fantasy of the future presents the various ways in which the world might some day end, as indicated by present scientific knowledge.

June: STARS OF A SUMMER'S NIGHT.

FELS PLANETARIUM

20th St. at Benjamin Franklin Parkway, Philadelphia 3, Pa., Rittenhouse 3050

SCHEDULE: 3 and 8:30 p.m. daily except Mondays; also 2 p.m. on Saturdays, Sundays, and holidays. 11 a.m. Saturdays, Children's Hour (adults admitted).

STAFF: *Director,* Roy K. Marshall. *Other lecturers:* I. M. Levitt, William L. Fisher, Armand N. Spitz, Robert W. Neathery.

May: ECLIPSES OF THE SUN. The historical importance of eclipses, as well as the scientific significance, will be discussed.

June: SUNSPOTS AND NORTHERN LIGHTS.

GRIFFITH PLANETARIUM

P. O. Box 9866, Los Feliz Station, Los Angeles 27, Cal., Olympia 1191

SCHEDULE: Wednesday and Thursday at 8:30 p.m. Friday, Saturday, and Sunday at 3 and 8:30 p.m. Extra show on Sunday at 4:15 p.m.

STAFF: *Director,* Dinsmore Alter. *Other lecturers:* C. H. Cleminshaw, George W. Bunton.

May: THE FROZEN PLANETS. Descriptions and motions of Jupiter, Saturn, Uranus, Neptune, and Pluto, and stories of the discoveries of the last three.

June: THE MIDNIGHT SUN.

HAYDEN PLANETARIUM

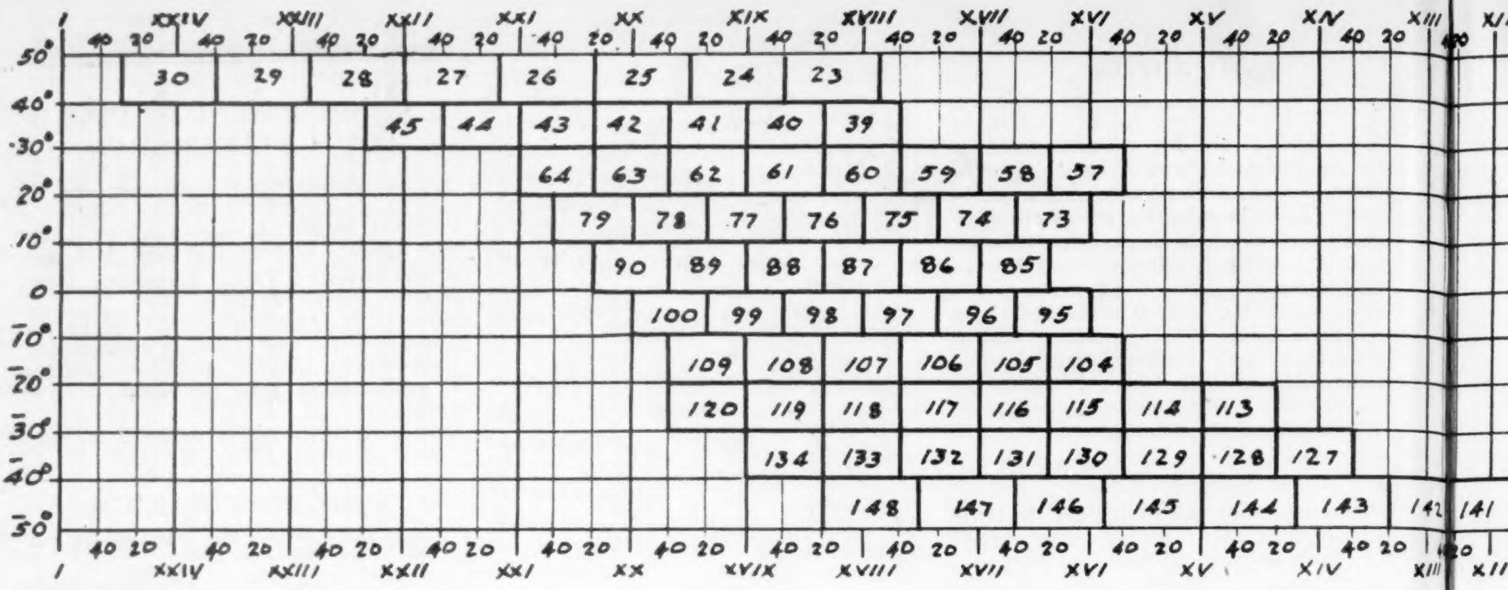
81st St. and Central Park West, New York 24, N. Y., Endicott 2-8500

SCHEDULE: Mondays through Fridays, 2, 3:30, and 8:30 p.m.; Saturdays, 11 a.m., 2, 3, 4, 5, and 8:30 p.m.; Sundays and holidays, 2, 3, 4, 5, and 8:30 p.m.

STAFF: *Honorary Curator,* Clyde Fisher. *Chairman and Curator,* Gordon A. Atwater. *Other lecturers:* Robert R. Coles, Catharine E. Barry, Shirley I. Gale, Edward H. Preston.

May: ECLIPSES. What causes an eclipse of the sun? See this stirring solar blackout demonstrated with time speeded up in the planetarium.

June: HISTORIC ASTRONOMICAL CATASTROPHES.



THE SEARCH F[...]

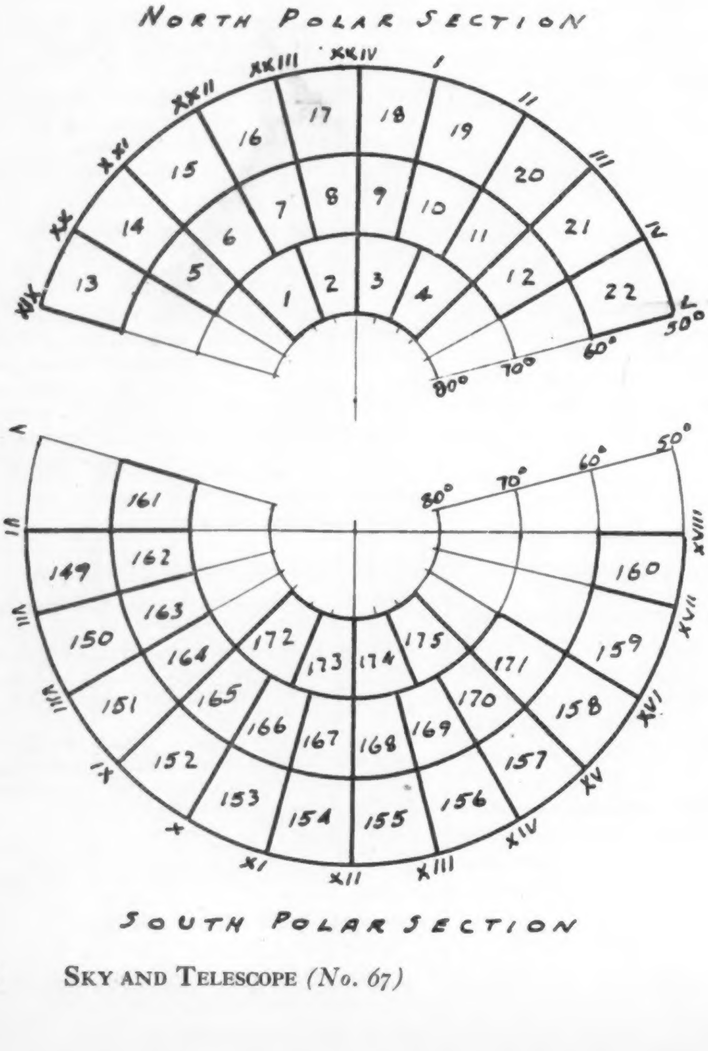
By the Nova Search Committee, *Am[...] A[...]*

Early on the night of June 8, 1918, E. E. Barnard, an American astronomer, after observing the eclipse of the sun on that day, was driving along a country road. His eyes wandered over the heavens to the constellation of Aquila and he exclaimed, "That star should not be there." He had discovered a *nova* or "new star." What he really saw was a star which in the space of a few hours had increased in brightness several thousandfold.

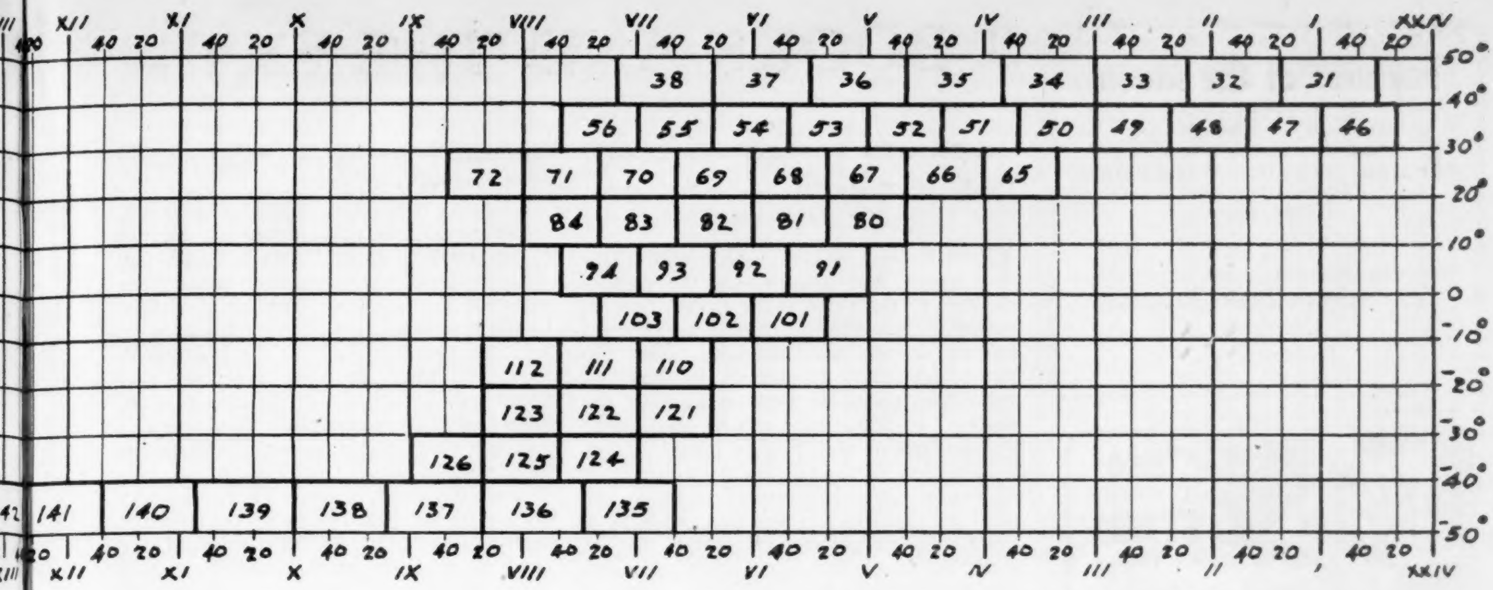
On the same night an amateur astronomer on a troopship, which was part of a blacked-out convoy, was pointing out the constellations to his buddies. Seeing this same bright star, they asked him to name it. He knew that no bright star should be in that location and thought it might be a planet, so dismissed the matter with a remark to that effect. This amateur who so narrowly missed being the discoverer of a nova was James S. Andrews, of Rutherford, N. J., who later became an active member of the American Association of Variable Star Observers.

The discovery and reporting of a nova is one of the most valuable contributions which we as amateur observers can make with little or no optical aid. One of these bright new stars appears on the average nearly every six years and the next one may flash into visibility at any time. Will you be the lucky first discoverer? Your discovery would put your name into astronomical history, in addition to which the AAVSO would present you with the David B. Pickering nova medal for the visual discovery of novae.

The nova seeker should familiarize himself with the locations of the bright variable stars, and also with the ever-changing positions of the planets so that he will not claim to be the discoverer of Venus or Jupiter. Scanning the entire dome of the heavens for a new or un-



These portions of the nova search chart show the north and south polar regions especially selected for detailed scrutiny. The north circumpolar areas include portions of Camelopardalis, Perseus, Cassiopeia, Cepheus, Lacerta, Cygnus, and Draco.



Areas for detailed nova search may be selected from this chart prepared by the Nova Search Committee of the AAVSO. The portions of the sky which are not numbered lie farther from the Milky Way and may be included in the search of the entire dome of the sky for bright novae.

FOR NEW STARS

an Association of Variable Star Observers

familiar object is simple for one who can recognize all the bright stars. There are 20 of the 1st magnitude, 60 of the 2nd, 180 of the 3rd. Since only about half of these are above the horizon at any one time, the amateur who knows the bright stars of the visible constellations should spot a bright nova with relative ease. To make certain of the identification of a 3rd-magnitude nova, however, a good star atlas or chart should be available for immediate reference. It does not seem advisable to attempt to identify all the visible stars in the heavens; the three brightest magnitudes will tax the memories of most observers who make a routine of checking the entire visible hemisphere of the sky.

To help and encourage and systematize the work of those who wish to aid in the prompt discovery of these cosmic atomic bombs, the Nova Search Committee of the AAVSO has prepared a chart of the Milky Way and divided this chart into numbered areas. The areas are 10 degrees high in the north and south direction, and their widths are marked by easily defined limits of right ascension. The east and west dimension was chosen in each case so that when seen in the sky the area appears very nearly as a square of 10 degrees. On the chart, an area near the poles seems quite different in shape and size from one near the equator, but when seen in the sky there is very little difference in their sizes.

Only the region of the Milky Way is divided for this closer and more detailed search. It is in this part of the sky that we see the major portion of our galaxy, and here most of the naked-eye novae have appeared in the past centuries. Whether or not you can see the entire dome of the sky, you should choose one or more of these areas for regular and minute study. Choose areas which are most easily seen from your location, and only as many as time and interest will allow you to study thoroughly and consistently. A star atlas or other maps will be necessary to enable you to identify all the naked-eye stars in each area. The best atlas for this purpose is the one issued at low cost by the AAVSO. Copies may be purchased from the chart committee chairman, Ferdinand Hartmann, 191-31 114th Drive, St. Albans 11, N. Y. A binocular of low power is of help, but not absolutely necessary.

It is well to observe on a regular schedule, usually at the beginning and ending of a night's observing, but check your areas at every favorable opportunity. Learn to identify all the stars of the 6th magnitude or brighter, and search each area down to the magnitude of the faintest star visible. If binoculars are not available, search by naked eye and record the magnitude of the faintest star visible.

A. A. V. S. O. Nova Search Program. Report for month of ________ 194__

By________________________

Address________________________

Stamp and Mail at End of Month to A. A. V. S. O., Cambridge, Mass.

Date											
Dome searched to mag.											
Civil Time											
Area____searched to mag.											
Civil Time											
Area____searched to mag.											
Civil Time											

Reports of nova search records should be made in a systematic manner with this sample as a guide. This reproduction shows in reduced size the special report postcard which the AAVSO will furnish upon request to amateurs who carry out a regular nova search observing program.

Any discovery or strong suspicion of a nova should be telegraphed immediately to Harvard College Observatory, Cambridge, Mass. All negative observations should be noted in a logbook showing the time, date, and magnitude of the faintest star identified in the searched area or on the visible dome of the sky. It is important to realize that negative reports are very valuable, as in the event of the discovery of a nova prior negative observations may assist in establishing the rate of increase of brightness.

At the end of each calendar month, observers should report to Mr. Leon Campbell, Recorder AAVSO, Harvard College Observatory, Cambridge 38, Mass. Use postcard, letter, or special report cards which will be furnished on request. The monthly reports should give complete data regarding each observation made during the month. A typical report card is shown here.

With the suggestions outlined above, any amateur astronomer who is a confirmed stargazer can turn his eyes upward, which he does anyway, and while he is enjoying the stars can make observations which are of value to professional astronomers.

Roy A. Seely, chairman
David W. Rosebrugh
Grace C. Rademacher, secretary

BOOKS AND THE SKY

A PRIMER FOR STAR-GAZERS

Henry M. Neely. Harper and Brothers, New York, 1946. 334 pages. $3.75.

HERE IS A BOOK which, with a few minor reservations, can be recommended to the skies, if the phrase be permitted. This is an outstandingly successful volume in accomplishing what the author set out to do, namely, to show the beginning stargazer how to identify the stars. The worst that can be said about the product of Mr. Neely's labors is that it was not fabricated in the form of a sphere, for in this reviewer's opinion the ideal mechanism for learning stars is a good celestial sphere, preferably that of a projection planetarium. However, since few tyros can be expected to be equipped with one of these, and books are flat, the criticism becomes an endorsement. Mr. Neely's flat pages (made of pleasant, high-finish paper) are covered with stimulating text and, particularly, with many star maps of noteworthy design and execution.

The "kindergarten approach," in the author's phrase, is used throughout the book, on his assumption that the novice, including the adult, feels appalled at the magnitude of the subject and the supposed difficulties of mastering any part of it. Two other assumptions will be heartily seconded by the thousands who have already joined the growing fraternity of stargazers — that this business of making friends with the stars is fun, and that there is nothing more difficult about it than is involved in working out a crossword puzzle. The author's enthusiastic conviction on these points is infectious, and his disarmingly breezy and conversational style will probably appeal to many who would leave a more cut-and-dried book lying on the shelf.

We could do no better, in expressing the specific purpose of **A Primer for Star-Gazers**, than to quote from the chapter entitled "How To Use This Book," in which the reader is thus addressed:

> If I could go outdoors with you, turn you to face the horizon in some exact direction and, pointing a certain distance up, say —
>
> "See that bright star up there — the brightest one you can see without turning your head."
>
> — you would immediately see it. Then if I said —
>
> "Now just a little lower than that star and a bit to the left, there are five stars — not nearly as bright but still quite plain. They form a cross. You can see three of them almost parallel with the horizon and two others, one above and one below the middle star."
>
> — you would study the sky a minute or two and then the form of the cross would become evident to you.
>
> Then I would probably tell you some of the amazing facts about two or three of those stars of Cygnus, or the Northern Cross . . . .
>
> Unfortunately for me, I cannot be with you in person tonight but the simple plan on which this book is constructed will serve the same purpose.
>
> *Once you understand this plan, you (and I vision you as an absolute novice) can go outdoors at any hour of any clear night in the year and point directly at any group of stars then visible in the sky, even though you may never have seen them before.*

The plan mentioned in the last sentence is the novel and most important feature of the book. For each constellation you wish to identify you are given those three essential items of information described in the quotation: first, which direction to face; second, how high in the heavens to look; and third, at what angle the star group will be situated at the time you are observing. To accomplish this, there is not one chart but a series of charts for each constellation, representing the successive positions it occupies in the sky during its westward journey through the night. These tell us how to hold the chart so that the stars in the chart will match the corresponding constellation in the heavens.

To enable us to know how high to hold the book, each chart is correlated with either the horizon, the zenith, or the point midway between the two. If the constellation is near the horizon, a conventional landscape of trees and houses in the picture gives us something solid to go by in judging altitude. If the constellation is too high for the horizon to offer a standard of reference, then on the chart a mark represents the point halfway up the sky. If the constellation is still higher, we find directions for raising the book until an indicated point in the picture is overhead.

Such is the simple, logical and workable plan underlying the construction and use of these star charts, of which there are approximately one hundred.

A necessary part of the plan remains to be mentioned, however. This is a series of Hour-and-Date diagrams. For each constellation such a diagram is supplied, and from it the stargazer can quickly determine which star chart he should use for the time of observation. Mention should also be made of a cross-referenced section which is a month-by-month guide to the visible constellations. These are separated into groups for beginners and for more advanced observers.

The book contains some of the basic mythology of the constellations, as well as notes regarding present-day knowledge of outstanding stars, such as their sizes, brightnesses, and distances. Fourteen reproductions of photographs present some of the wonders of the sky as revealed by telescopes. A few misstatements of fact have crept into the text (such as that Rigel is the most luminous of the stars, and that the standard distance used in computing absolute magnitude is 33 1/3 light-years), but in general the text as well as the star charts evidence painstaking care in preparation. All in all this book may well be destined to take its place among the few others on the subject which have come to be regarded more or less as "classics," and it is worthy to be perpetuated by numerous editions.

ARTHUR L. DRAPER
Buhl Planetarium

ASTRONOMY

Freeman D. Miller. Bellman Publishing Company, Inc., Boston, 1947. 29 pages. 75 cents.

A LETTER comes in the mail, written in a somewhat unformed hand and stating, "I am 14 years old and have been interested in astronomy since I was nine. I have read all of Jeans' books and several other astronomy books. I am a sophomore in high school. Please tell me how I can be an astronomer."

Another person writes, "Lately my interest has been strongly attracted to astronomy. I have an engineering degree and a sound background in physics, and can continue to study further. I would appreciate any advice you can give me on the possibility of adopting astronomy as a career."

Letters like these are frequently received by every observatory and planetarium in the country. Now there is available a unique pamphlet which can answer soundly the questions of persons interested in astronomy as a vocation. Dr. Miller's treatment is objective and concise. He opens with a brief historical survey, continues with a discussion of the subject matter of modern astronomy, also brief, and then swings into the heart of the problem: personal qualifications and scholastic training necessary; various employment opportunities; positions for women; organizations and publications in the field. There is a table of salary scales reproduced from a Department of Labor publication, and a section on possibilities of advancement for the individual. There is a list of representative departments of astronomy in American colleges and universities.

The booklet should be on the desk of anyone who is called upon to give guidance to potential astronomers. The staffs of observatories and planetariums, and the libraries of such institutions, persons connected with science activities in high schools and colleges, members of amateur and junior astronomy groups, may well find this publication of considerable value. It is also important to those who want to know why, in their particular case perhaps, astronomy should not be adopted as a lifetime work.

This booklet on astronomy is No. 72 of a series of such vocational and professional monographs put out by the same publishers. The list of 75 titles covers a tremendous range, and if all the booklets are on a level with this one, the project is assuredly commendable. H. S. F.

NEW BOOKS RECEIVED

THE EARTH AND THE STARS, *C. G. Abbot*, 1946, *Van Nostrand*. 288 pages. $3.75.

An easily read survey of the universe, designed for the non-technical reader. It is written by the former secretary of the Smithsonian Institution.

GLEANINGS FOR A. T. M.s

Vignettes of Telescope Making History

R. W. POTTS, of Cambridge, England, sends us a few interesting items concerning the history of telescope making and of some of the famous individuals connected therewith. On the front cover this month appears a historical instrument, a Gregorian reflector made by Short about 1750, about which Mr. Potts writes as follows:

"The telescope was found in its original box and in perfect order — it is in use today. It originally had two secondary speculums, but only one was with the instrument. The two eyepieces give magnifications of about 60x and 80x, as tested by Dr. W. H. Steavenson, though Short said they were about 55x and 95x. The primary mirror is four inches in diameter, with an 18-inch focal length, and the equivalent focal length of the combination is about 160 inches. The sighting telescope with cross wires is adjustable but, of course, not achromatic; it is composed of only two lenses.

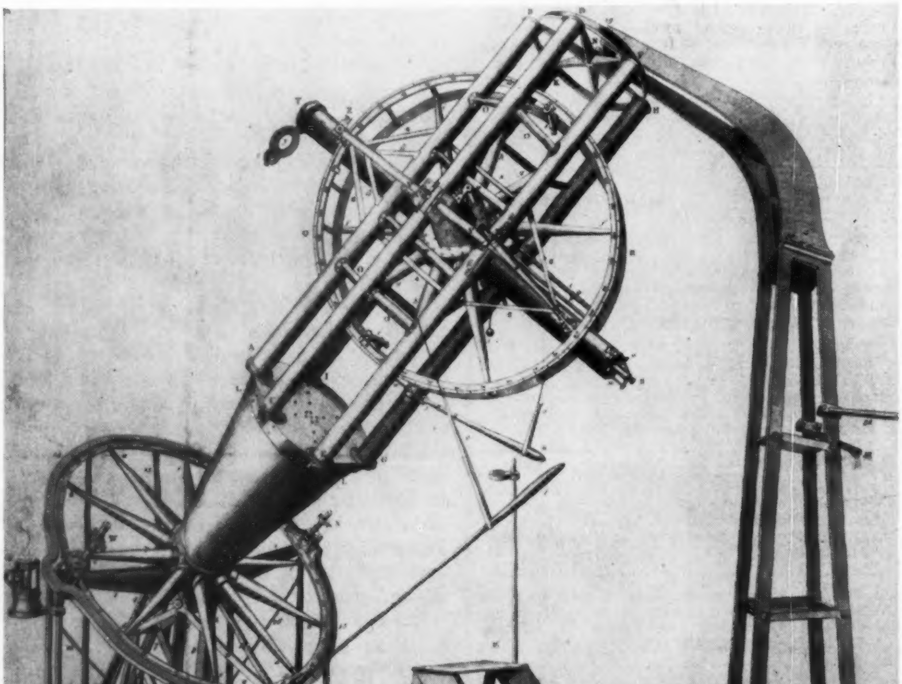
"Definition is fair, showing stars down to the 9th and 10th magnitude, and separations down to 2.5 seconds of arc. The instrument was mounted on a table stand — I made the tripod shown in the [cover] photograph for my own use."

The original instructions pasted to the box of the instrument are reproduced here. Mr. Potts believes the handwriting in the margin to be that of Short himself.

Another item transmitted by our correspondent concerns the equatorial telescope built by Jesse Ramsden in 1791. The sketch here is reproduced from the printed version of a paper given by Sir George Shuckburgh to the Royal Society on March 21, 1793. Mr. Potts discussed this telescope in an article on the life of Jesse Ramsden (1735-1800) in the **Journal** of the British Astronomical Association, in June, 1945.

Ramsden published in 1774 a patent for a "New Universal Equatorial," and in 1777 developed an engine for dividing mathematical instruments. In addition to improving sextants, "he devised novel methods for illuminating the wires of transits and determining the collimation errors; an instrument for ascertaining telescopic powers; and the first to apply 'reading of microscopes to circular instruments.' One of the most famous works," Mr. Potts continues in his article, "was a five-foot vertical circle turned out in 1789 under the personal supervision of Piazzi of the Palermo Observatory. From observations made with it Piazzi constructed his great star catalogue; a similar but larger instrument was built for Dublin Observatory.

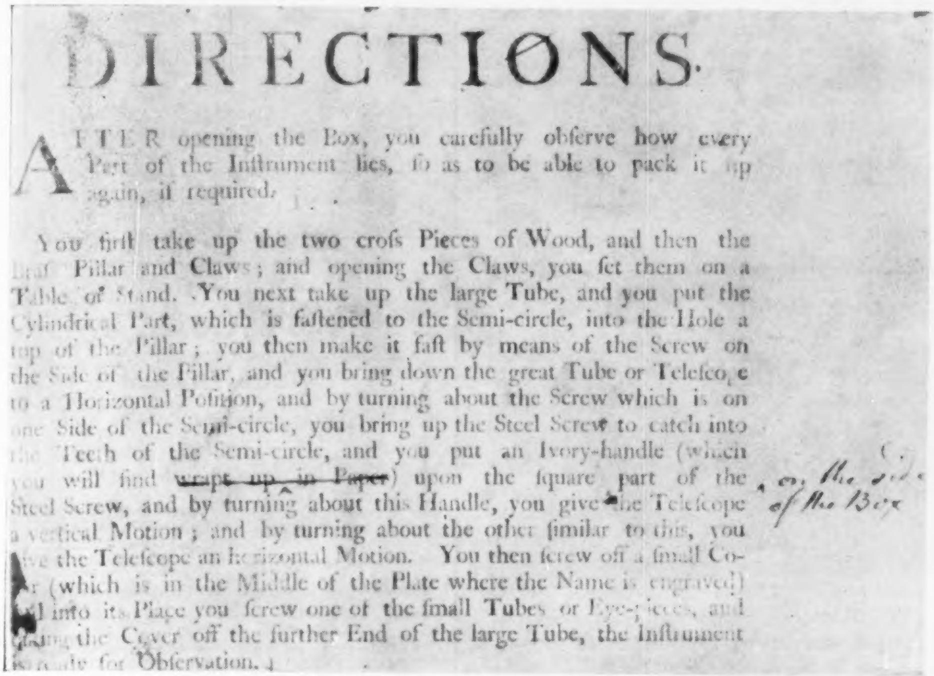
"The year 1791 saw a new edition of a 'New Universal Equatorial' with additions, as the original stock had been destroyed by fire . . . . It is to a paper . . . by Shuckburgh . . . that we are indebted for the description and sketches of this now



The equatorial telescope designed by Ramsden in 1791. The instrument is an achromatic refractor of 4.2 inches aperture.

Edited by Earle B. Brown

famous equatorial. In the sketch of this telescope the polar axis, consisting of six brass tubes, is supported at either end by iron framework, which is carefully braced by stays fixed into the wall of the observatory, and also into the floor to prevent any kind of twisting movement. The upper ends of the tubes are firmly fixed in a circle of bell metal, and at the lower end to an inverted truncated hollow cone of brass some two feet in height. Cross-tubes serve to connect the columns together and prevent bending. These several parts constitute the polar axis, the lower end of


DIRECTIONS.

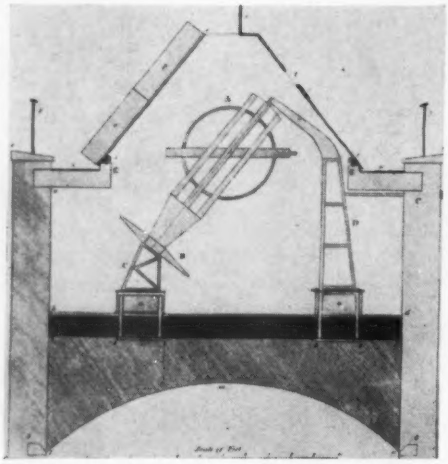
AFTER opening the Box, you carefully obſerve how every Part of the Inſtrument lies, ſo as to be able to pack it up again, if required.

You firſt take up the two croſs Pieces of Wood, and then the Braſs Pillar and Claws; and opening the Claws, you ſet them on a Table or Stand. You next take up the large Tube, and you put the Cylindrical Part, which is faſtened to the Semi-circle, into the Hole a top of the Pillar; you then make it faſt by means of the Screw on the Side of the Pillar, and you bring down the great Tube or Teleſcope to a Horizontal Poſition, and by turning about the Screw which is on one Side of the Semi-circle, you bring up the Steel Screw to catch into the Teeth of the Semi-circle, and you put an Ivory-handle (which you will find ~~wrapt up in Paper~~ on the side of the Box) upon the ſquare part of the Steel Screw, and by turning about this Handle, you give the Teleſcope a vertical Motion; and by turning about the other ſimilar to this, you give the Teleſcope an horizontal Motion. You then ſcrew off a ſmall Cover (which is in the Middle of the Plate where the Name is engraved) and into its Place you ſcrew one of the ſmall Tubes or Eye-pieces, and taking the Cover off the further End of the large Tube, the Inſtrument is ready for Obſervation.

The instructions for the Gregorian telescope pictured on the front cover and made by Short about 1750.

which terminates in a steel point or cone, resting in a hollow conoid of bell metal in such a manner that the apex of the former does not reach the bottom of the latter, the bearing surface being about two-tenths of an inch from the extremity of the cone; the total height from floor to ceiling being some 10 feet. Large circles were the order of the day, as can be seen, and on them were the reading microscopes, the first to be so applied . . . .

"The telescope in the sketch was a double achromatic, with a combined focus of 65 inches and an aperture of 4.2 inches,



The Ramsden equatorial was mounted in the observatory in the manner shown in this sketch.

which, as it may be observed, could be stopped down. Two sets of eyepieces were provided, one single and the other double; of these latter the magnifying powers were from 60 to 360 times, of the former from 150 to 550 times. To these were added a prism eye-tube for objects near the zenith or pole, with a power of about 100 times. There was also a tube with a divided eyeglass micrometer with a power of 80 times, but, says Sir George, 'the scale is so small, not more than 10 minutes, that it is in truth of little use.' To continue the description. 'The double eye-tubes are composed of two eyeglasses, to enlarge the field and render it more agreeable, both placed on the hither side of the cross-wires, so that they may at any time be changed without damaging the wires.' This is of course the first description of the Ramsden eyepiece.

"For observations of transits and polar distances the compound eyepiece by 60 times was generally used. For observations of the planets higher powers were used, of these by 400 times seemed to be the maximum the glass would bear; with 500 times the image was not so well defined, but with 200 or 300 times the image was beautifully distinct and bright.

"The smaller sketch gives a good outline of the general scheme of erection and position within the observatory: note the thick walls and the arch floor, designed to give the greatest stability possible. Many other items common to observatories completed the outfit: lamps, plumb-lines, clocks, etc.

"It would be interesting to know if any of these items or the telescope itself is still in existence . . . ."

UNUSUAL WAR BARGAINS in LENSES and PRISMS

ASSEMBLE YOUR OWN BINOCULARS!

COMPLETE OPTICS! COMPLETE METAL PARTS! SAVE MORE THAN ½ REGULAR COST!

ARMY'S 7 X 50 BINOCULARS

Here's an unusual opportunity to secure a fine set of Binoculars at a substantial saving of money. Offered here are complete sets of Optics and Metal Parts for the Army's M-16 7 x 50 Binoculars (M-16 is not the waterproof model). These components are new and all ready for assembly. We supply full instructions. Limit — 1 set of Metal Parts and 1 set of Optics to a customer.

METAL PARTS—Set includes all Metal Parts — completely finished — for assembly of 7 x 50 Binoculars. No machining required. Bodies have been factory hinged and covered. A sturdy Binocular Carrying Case is included with each set of Metal Parts.
Stock #824-Y, 7 x 50 Metal Parts, $35.00 Postpaid

OPTICS—Set includes all Lenses and Prisms you need for assembling 7 x 50 Binoculars. These Optics are in excellent condition — perfect or near perfect — and have new low reflection coating.
Stock #5102-Y, 7 x 50 Optics, $25.00 Postpaid

NOTICE! If you buy both the Binocular Optics and the Binocular Metal Parts, your purchase becomes subject to 20% Federal Excise Tax. Be sure to add amount covering tax to your remittance or your order cannot be filled.

ARMY'S 6 X 30 BINOCULARS

No Carrying Case with any Sets shown below. (None yet available in Surplus Market.) M-13A1 Sets are waterproof model. M-3 Sets are not waterproof. Limit — 1 Set to a Customer on all Sets shown below.

COMPLETE OPTICS & METAL PARTS—Model M-13A1, 6 x 30 Binoculars. Everything you need — ready for assembly. When finished will look like a regular factory job costing $102 to $1.0. The Optics are new, in perfect or near perfect condition. Have new low reflection coating. Metal Parts are new and perfect, all completely finished. No machining required. Bodies factory hinged and covered. Complete assembly instructions included.
Stock #830-Y .... $40.00 Postpaid, plus $8.00 tax .... Total, $48.00

COMPLETE OPTICS & METAL PARTS—Model M-3, 6 x 30 Binoculars. The Optics in this set are new, perfect or near-perfect. Prisms have new low reflection coating. Factory mounted Eye Piece and Objective Assemblies not coated. Metal Parts are perfect, new, ready for assembly. When finished, this will look like a regular factory job, except a name has been filed off a cover plate. No machining required. Bodies factory hinged and covered.
Stock #831-Y .... $35.00 Postpaid, plus $7.00 tax, ... Total, $42.00

METAL PARTS ONLY—Model M-13A1, 6 x 30 Binoculars. No Optics. Same Metal Parts as described for Stock #830-Y.
Stock #832-Y, 6x30 Metal Parts, $25.00 Postpaid

METAL PARTS ONLY—Model M-3, 6 x 30 Binoculars. No Optics. Some machining on these Metal Parts required. Bodies hinged and Prism Shelf holes placed, but you must tap them. Prism Shelves have been machined. Six lead spiral focusing threads have been cut. Some less difficult components you must thread and machine yourself, but all material you need is furnished except body covering material and Optics.
Stock #833-Y, 6x30 Metal Parts, $12.00 Postpaid

OPTICS FOR 6 x 30 BINOCULARS (No Metal Parts.) Slight seconds. Cemented but not coated.
Stock #5123-Y .... $10.00 Postpaid

SAME OPTICS AS ABOVE (6 x 30), but coated.
Stock #5124-Y .... $12.75 Postpaid

If you buy both the Binocular Optics and the Binocular Metal Parts, your purchase becomes subject to 20% Federal Excise Tax. Be sure to add amount covering tax to your remittance or your order cannot be filled.

Optics and Metal Parts are Available for Monoculars (½ a Binocular). For Complete Details, Write for Bulletin #14-Y.

Stock #1-Y — "Our Advertising Special" — 15 lenses for $1.60 Postpaid, plus 10-page idea booklet. For copying, ULTRA CLOSE-UP SHOTS macrophotography, experimental optics, magnifying and for making a two power f/16 Telephoto Lens, "Dummy Camera," Kodachrome Viewer, DETACHABLE REFLEX VIEW-FINDER for 35 mm. cameras, stereoscopic viewers, ground glass and enlarging focusing aids, TELESCOPES, low power Microscopes and for many other uses.

NEW 50-PAGE IDEA BOOK "FUN WITH CHIPPED EDGE LENSES"

Contains wide variety of projects and fully covers the fascinating uses of all Lenses in sets listed above . . . only **$1.00 Postpaid.**

35 MM. KODACHROME PROJECTING LENS SET—Consists of Achromatic Lens for projecting, plus a Condensing Lens and a piece of Heat Absorbing Glass with directions.
Stock #4025-Y .... $1.95 Postpaid

35 MM. KODACHROME PROJECTING LENS SET—Consists of 2 Achromatic Lenses for projecting, plus 2 Condensing Lenses and piece of Heat Absorbing Glass with directions.
Stock #4029-Y .... $3.10 Postpaid

CONDENSING LENSES for 35 mm Projectors and Enlargers. Consists of set of 2 Lenses — diam. 2⅜", F.L. 3" each.
Stock #1077-Y .... $2.00 Postpaid

WE HAVE LITERALLY MILLIONS OF WAR SURPLUS LENSES AND PRISMS FOR SALE AT BARGAIN PRICES. WRITE FOR CATALOG "Y" — SENT FREE!

2-½" DIA. ACHROMATIC TELESCOPE OBJECTIVE—F.L. 20 inches. (Not a war surplus item.) The Govt. used very few long focus Objective Lenses so we had these made for you. First class lens suitable for Spotting Scopes, Terrestrial Telescopes, etc. Not coated.
Stock #6197-Y .... $10.00 Postpaid

SPECTROSCOPE SETS

These sets contain all Lenses and Prisms you need to make a Spectroscope plus FREE 15-page Instruction Booklet.
Stock #1500-Y—Hand Type .... $3.45 Postpaid
Stock #1501-Y—Laboratory Type . $6.50 Postpaid

RAW OPTICAL GLASS

An exceptional opportunity to secure a large variety of Optical Pieces both Crown and Flint glass (seconds) in varying stages of processing. Many prism blanks.
Stock #703-Y—8 lbs. (min. wt.)—**$5.00 Postpaid**
Stock #702-Y—1½ lbs. .... **$1.00 Postpaid**

TANK PRISMS

Plain or Silvered

90-45-45 deg. 5¾" long, 2⅛" wide, finely ground and polished.
Stock #3004-Y Silvered Prism (Perfect) .... **$2.00 Postpaid**
Stock #3005-Y Plain Prism (Perfect) .... **$2.00 Postpaid**
Stock #3100-Y Silvered Prism (Second) .... **$1.00 Postpaid**
Stock #3101-Y Plain Prism (Second) .... **$1.00 Postpaid**
(Illustrated Book on Prisms included FREE)

All Items Finely Ground and Polished but Some Edges Slightly Chipped or Other Slight Imperfections Which We Guarantee Will Not Interfere with Their Use. Come Neatly Packed and Marked.

TO KEEP POSTED on all our new Optical Items, send 10¢ and your name and address to get on our regular "Flash" mailing list.

23 POWER PRISM SPOTTING TELESCOPE SET—Optics consist of perfect Achromatic Objective with dia. of 64 mm. and 20 inch F.L. (not a War Surplus item), an Eye Achromat, Field Lens and Prisms from 6 x 30 Binocular. These are slight seconds. All low reflection coated except Objective. Half a covered 6 x 30 Binocular Body, all parts for Eyepiece end and Prism Shelf section are supplied. You must furnish an extension tube and any parts needed to mount the Objective Lens.
Stock #5127-Y .... $21.00 Postpaid

SCHMIDT OPTICAL SYSTEM. Black plastic body, size 3-15/16" by 5-½". F.L. 2.4" . . . with amazing speed of F.0.9. Used in Navy's Infra-Red Sniperscope and Signalling Units. Govt. cost $134. Limit — 1 to a customer.
Stock #720-Y .... $6.00 Postpaid

MOUNTED PROJECTING LENS SYSTEM. F.L. 91.44 mm. (just right for 35 mm. Projectors). Speed of F.1.9. Outside dia. of mount at one end 60 mm. Length of mount 64 mm.
Stock #4033-Y .... $3.00 Postpaid

MOUNT FOR ABOVE PROJECTING LENS SYSTEM — Stock #715-Y .... $1.50 Postpaid

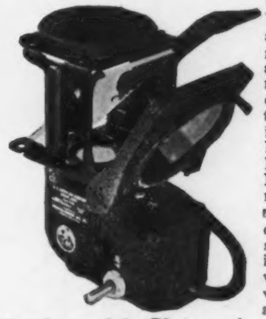
MOUNTED KELLNER TELESCOPE EYE PIECE — Perfect, coated, in Ordnance sealed boxes. F.L. 1¾ inches. Outside dia. of steel mount 40 mm.
Stock #6198-Y .... $3.15 Postpaid

OPTICAL BENCH KIT — (Not a War Surplus Item) Everything you need, including four Lens Holders for checking Focal Lengths and setting up Lens Systems.
Stock #53-Y .... $8.50 Postpaid

BATTERY COMMANDER'S PERISCOPE With Tripod—6 Power Instrument. Excellent condition. Length 27½ inches — diam. 1½ inches. Cost U. S. Govt. approximately $175.00.
Stock #717-Y .... $20.00 F.O.B. Audubon

AIR FORCES GUNSIGHT

With Polarizing Variable Density Attachment



Can be used as Slide Viewer, or take it apart and you can get Polarizing Variable Density Attachment, Mangin Concave Mirror, Reflector Plate, Metal Reticle, Window, Lamp Housing, Ring and Bead Sight. The Polarizing attachment alone is worth many times the price of entire unit. Consists of 2 Polarizing Filters mounted with small handle which rotates one around the other. May be used in Photography, Research, Experiments, as Light Dimmer, etc.
Stock #908-Y .... $5.00 Postpaid

Same Unit Without Polarizing Attachment
Stock #916-Y .... $2.50 Postpaid

BOMBER SIGHTING STATION—A double end Periscope Type Instrument of highest precision. Brand new and in perfect condition. 6 ft. tall, shipping wt. 360 lbs. Orig. cost $9,850. Consists of numerous Lenses, Prisms, Mirrors, Gears, Motors, Metal Parts and Electrical Gadgets.
Stock #914-Y .... $50.00 F.O.B. Oklahoma

POLARIZING VARIABLE DENSITY ATTACHMENT FOR 7 x 50 BINOCULARS—An amazingly effective unit for controlling amount of light reaching your eyes. Cuts down glare in sky and overwater observations. Easily snapped on and off over the eye cups of American-made 7 x 50 Binoculars. Govt. cost $8.30 each.
Stock #20,000-Y .... $2.00 Postpaid

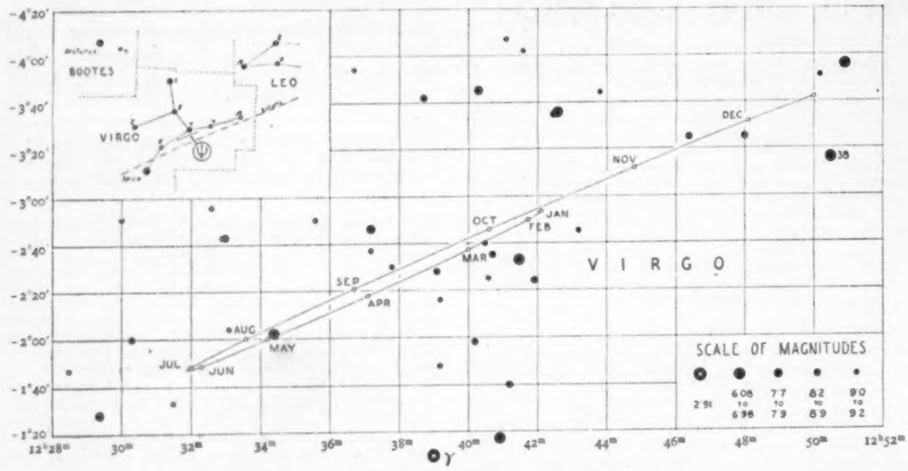
SATISFACTION GUARANTEED • ORDER BY STOCK NO.

EDMUND SALVAGE COMPANY + P. O. AUDUBON, NEW JERSEY

OBSERVER'S PAGE

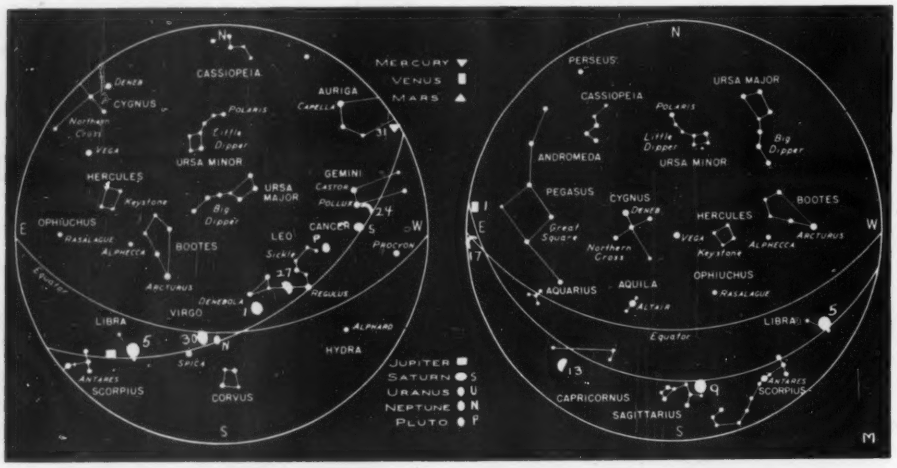
Greenwich civil time is used unless otherwise noted.

THE PATH OF NEPTUNE DURING 1947



This chart is reproduced from the Handbook of the British Astronomical Association. South is at the top. On March 31st, Neptune was of magnitude 7.7.

THE MOON AND PLANETS IN THE EVENING AND MORNING SKIES



In mid-northern latitudes, the sky appears as at the right at 3:30 a.m. local time on the 7th of the month, and at 2:30 a.m. on the 23rd. At the left is the sky for 9:30 p.m. on the 7th and 8:30 p.m. on the 23rd. The moon is shown for certain dates by symbols which give roughly its phase. Each planet has a special symbol, and is located for the middle of the month, unless otherwise marked. The sun is not shown, although at times it may be above the indicated horizon. Only the brightest stars are included, and the more conspicuous constellations.

Sun. A total eclipse will occur on May 20th, visible across South America and Africa.

Mercury begins the month in the morning sky, although close to the sun, and passes the sun on the 15th, on the distant side of its orbit (superior conjunction). By the last week of May, Mercury may be seen without difficulty after sunset above the western horizon, setting over an hour after the sun, and of magnitude about -0.6.

Venus rises about an hour before the sun, and is of little interest. It passes slower moving Mars on the 17th, Venus 1° south.

Mars may be seen with difficulty one hour before sunrise.

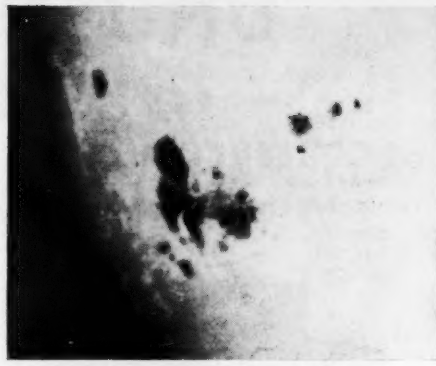
Jupiter. Opposition with the sun occurs on May 14th, and the planet may be seen all night. Its magnitude is -2.1, brightest this year. Jupiter is in Libra and will be only 30° above the horizon at transit. The close conjunction with the moon on the 6th is an occultation in the Southern Hemisphere.

Saturn is visible only in the evening hours. The ringed planet moves only a short distance eastward in Cancer during the month. The stellar magnitude is $+0.5$.

Uranus can no longer be seen in the evening sky, due to the proximity of the sun.

Neptune continues in retrograde motion, and may be found with the aid of a small telescope, close to Gamma Virginis. The position on the 15th is $12^h\ 33^m$, $-1°\ 53'$ (1947).

E. O.



LARGE SUNSPOT GROUP MAKES A THIRD APPEARANCE

On March 5th, this picture of an enormous sunspot group measuring nearly 50,000 miles across was taken by Gordon Newkirk at Harvard University. He employed a 4-inch refractor, process plate, and a yellow filter in front of the plate.

By March 11th, the Naval Observatory reported the spot group to be one of the nine or 10 largest in history; it was easily visible to the naked eye. On April 3rd, the group appeared again on the sun's eastern limb, where it was photographed by the Rev. William Kearons, of Fall River, as shown on page 7.

Science Service reports that this is the third trip of this group around the sun, and that the spot group may be large enough to survive for a fourth return at the end of April. On the average, about one group in 240 lasts for a fourth appearance.

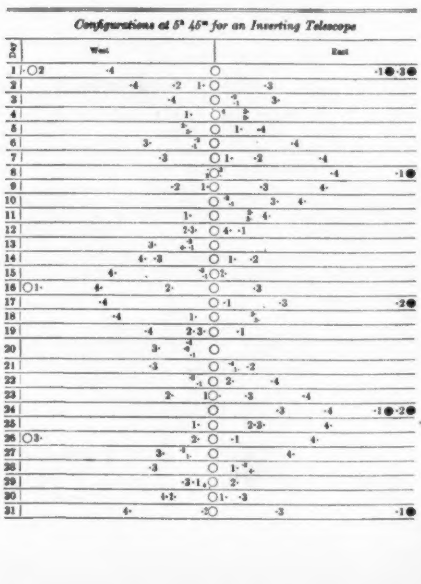
Another picture of this sunspot, made on March 9th, is on the cover of the April issue of the "Griffith Observer."

PHASES OF THE MOON

Full moon	May 5, 4:53
Last quarter	May 13, 8:08
New moon	May 20, 13:44
First quarter	May 27, 4:35
Full moon	June 3, 19:27

JUPITER'S SATELLITES

Jupiter's four bright moons have the positions shown below for the GCT given. The motion of each satellite is from the dot to the number designating it. Transits of satellites over Jupiter's disk are shown by open circles at the left, and eclipses and occultations by black disks at the right. Reproduced from the American Ephemeris and Nautical Almanac.



OCCULTATIONS FOR MAY

7-8 **136 G Ophiuchi** 6.3, 17:23.6 −25-53.9, 17, Em: **A** 8:08.0 −2.1 −0.1 251; **B** 8:05.2 −2.0 −0.2 255; **C** 7:56.8 −2.6 +0.5 244; **D** 7:52.8 −2.3 +0.3 250; **E** 7:17.9 −3.3 +2.2 229.

8-9 **66 B Sagittarii** 4.7, 18:14.7 −27-03.8, 18, Im: **A** 5:30.6 −0.6 −0.4 145; **C** 5:33.6 +0.5 −2.1 166. Em: **A** 6:31.0 −2.5 +1.6 237; **B** 6:33.1 −2.2 +1.4 241; **C** 6:10.0 −3.4 +3.4 219; **D** 6:16.1 −2.5 +2.3 232.

26-27 **46 Leonis** 5.7, 10:29.4 +14-24.6, 6, Im: **A** 2:21.3 −0.8 −1.8 117; **B** 2:15.4 −0.8 −1.7 114; **C** 2:24.6 −0.7 −2.0 129; **D** 2:13.6 −0.9 −1.8 125; **E** 2:11.9 −0.7 −2.4 150.

29-30 **48 Virginis m** 6.5, 13:01.2 −3-22.7, 9, Im: **A** 5:21.7 −0.6 −2.2 146; **B** 5:14.4 −0.6 −2.1 142; **C** 5:27.3 −0.6 −2.4 154; **D** 5:14.8 −0.7 −2.2 149; **E** 5:16.4 −0.5 −2.7 169; **G** 4:45.1 ... ... 196.

For selected occultations (visible at three or more stations in the U. S. and Canada under fairly favorable conditions), these predictions give: evening-morning date, star name, magnitude, right ascension in hours and minutes and declination in degrees and minutes, moon's age in days, immersion or emersion; standard station designation, GCT, **a** and **b** quantities in minutes, position angle; the same data for each standard station westward.

Longitudes and latitudes of standard stations are:

A +72°.5, +42°.5	E +91°.0, +40°.0
B +73°.6, +45°.6	F +98°.0, +30°.0
C +77°.1, +38°.9	G +114°.0, +50°.9
D +79°.4, +43°.7	H +120°.0, +36°.0
I +123°.1, +49°.5	

The **a** and **b** quantities tabulated in each case are variations of standard-station predicted times per degree of longitude and of latitude respectively, enabling computation of fairly accurate times for one's local station (long. **Lo**, lat. **L**) within 200 or 300 miles of a standard station (long. **LoS**, lat. **LS**). Multiply **a** by the difference in longitude (**Lo — LoS**), and multiply **b** by the difference in latitude (**L — LS**), with due regard to arithmetic signs, and add both results to (or subtract from, as the case may be) the standard-station predicted time to obtain time at the local station. Then convert the Greenwich civil time to your own standard time.

For additional occultations consult the **American Ephemeris and Nautical Almanac** and the British **Nautical Almanac**, from which these predictions are taken. Texas predictions were computed by E. W. Woolard and Paul Herget.

MINIMA OF ALGOL

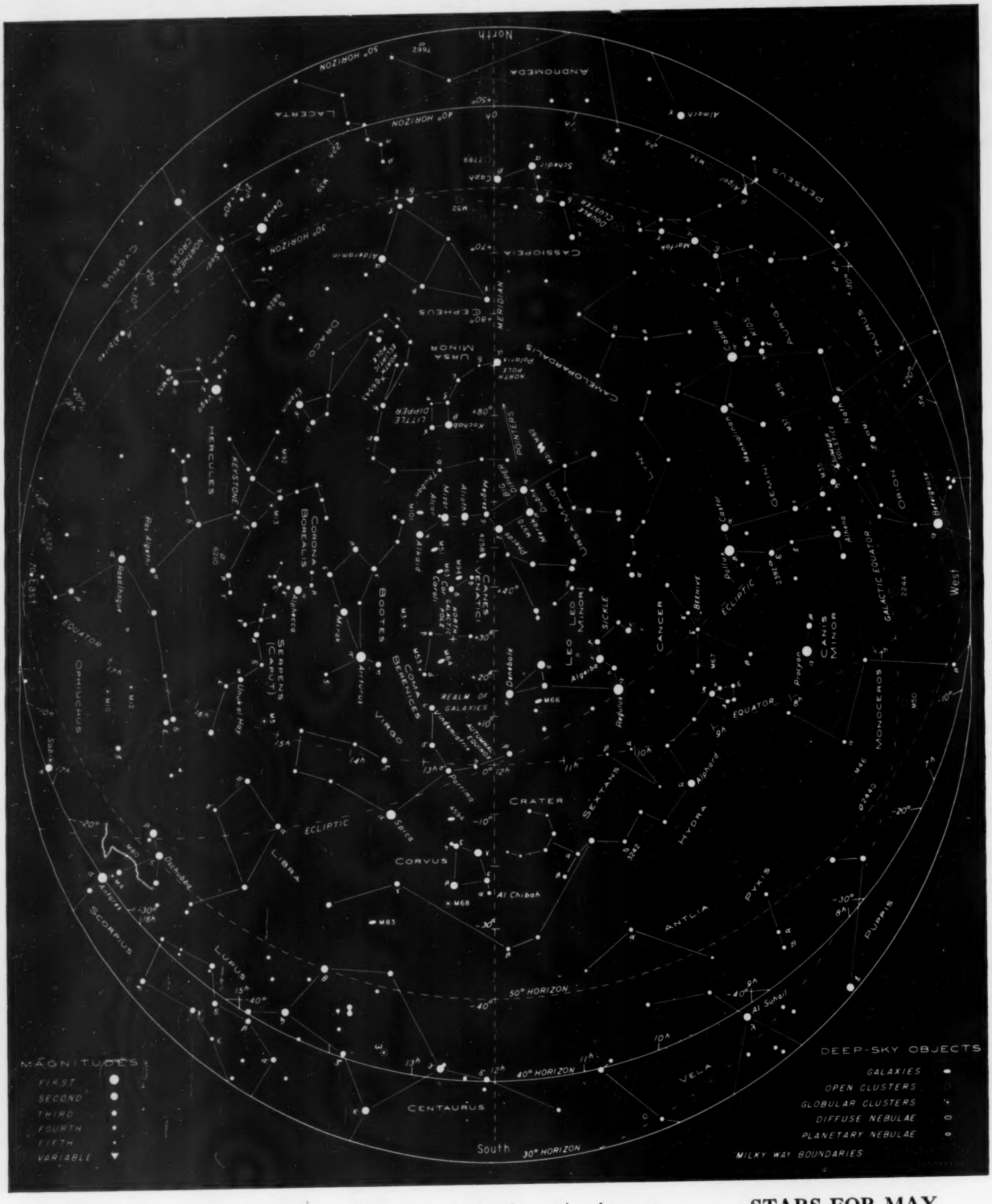
May 2, 23:00; 5, 19:49; 8, 16:38; 11, 13:27; 14, 10:16; 17, 7:05; 20, 3:54; 23, 0:42; 25, 21:31; 28, 18:20; 31, 15:09. June 3, 11:58.

VARIABLE STAR MAXIMA

May 5, R Cancri, 6.8, 081112; 7, RS Librae, 7.7, 151822; 11, T Ursae Majoris, 7.9, 123160; 15, R Ursae Majoris, 7.6, 103769; 19, V Coronae Borealis, 7.4, 154639; 24, R Hydrae, 4.6, 132422; 26, RT Hydrae, 7.6, 082405; 29, R Draconis, 7.6, 163266; 31, R Sagittarii, 7.2, 191019. June 6, X Monocerotis, 7.6, 065208.

GREENWICH CIVIL TIME (GCT)

TIMES used on the Observer's Page are Greenwich civil or universal time, unless otherwise noted. This is 24-hour time, from midnight to midnight; times greater than 12:00 are p.m. Subtract the following hours to convert to standard times in the United States: EST, 5; CST, 6; MST, 7; PST, 8. If necessary, add 24 hours to the GCT before subtracting, and the result is your standard time on the day preceding the Greenwich date shown.



STARS FOR MAY

from latitudes 30° to 50° north, at 9 p.m. and 8 p.m., local time, on the 7th and 23rd of the month, respectively. The 40° north horizon is a solid circle; the others are circles, too, but dashed in part. When facing north, hold "North" at the bottom, and similarly for other directions. This is a stereographic projection, in which the flattened appearance of the sky itself is closely reproduced, without distortion.

DEEP-SKY WONDERS

WHILE the great nebula fields of Virgo and Coma dominate the May skies (see this department, May, 1946), there are other worthwhile objects. Observers far enough south can see the Omega Centauri cluster, $13^h\ 20^m.7$, $-47°\ 18'$, visible to the naked eye as a star between 4th and 5th magnitude. The slightest optical aid makes it as fine as the Hercules cluster is in larger instruments, and in a 6-inch RFT it becomes the most magnificent cluster in the entire heavens.

NGC 3242, $10^h\ 19^m.9$, $-18°\ 08'$, a planetary nebula, 20″ diameter, with an 11th-magnitude central star which is 9th magnitude photographically. Lick exposures show a complicated structure.

NGC 4594, 43^1, $12^h\ 37^m$, $-11°\ 21'$, mag. 8.1, 7′ x 1.5′, a bright spiral lying edgewise. John Herschel detected dark lanes visually — confirmed in the days of photography (see back cover, **Sky and Telescope**, June, 1942).

WALTER SCOTT HOUSTON